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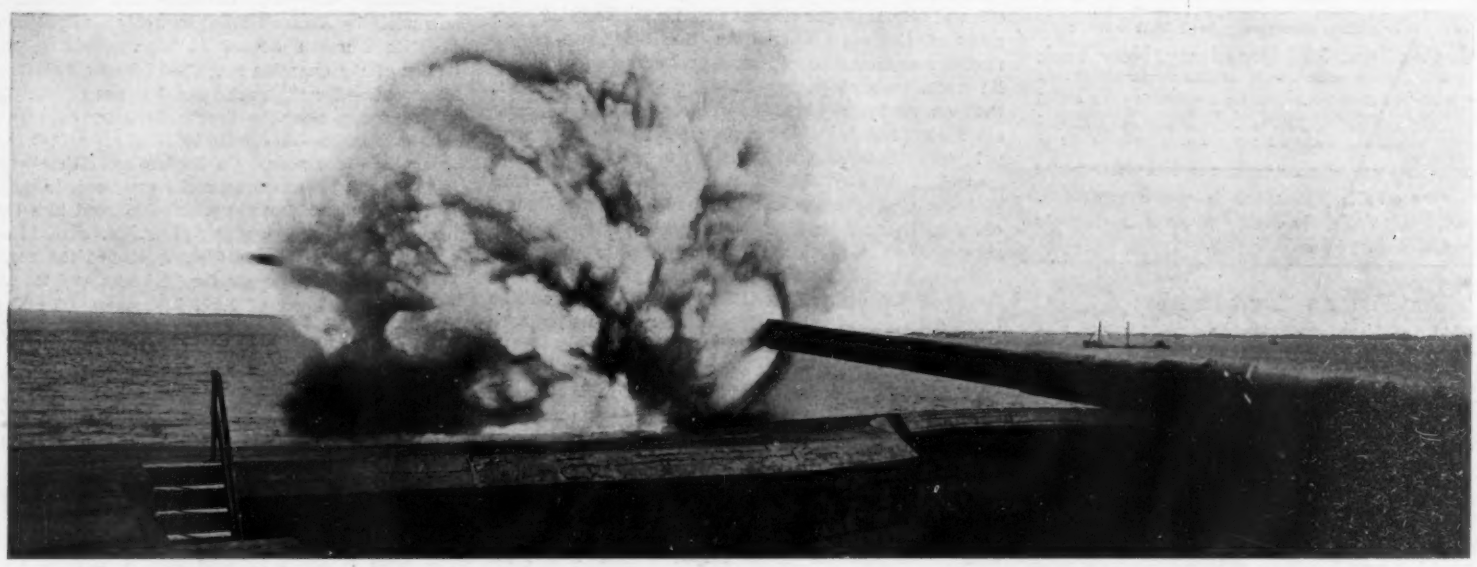

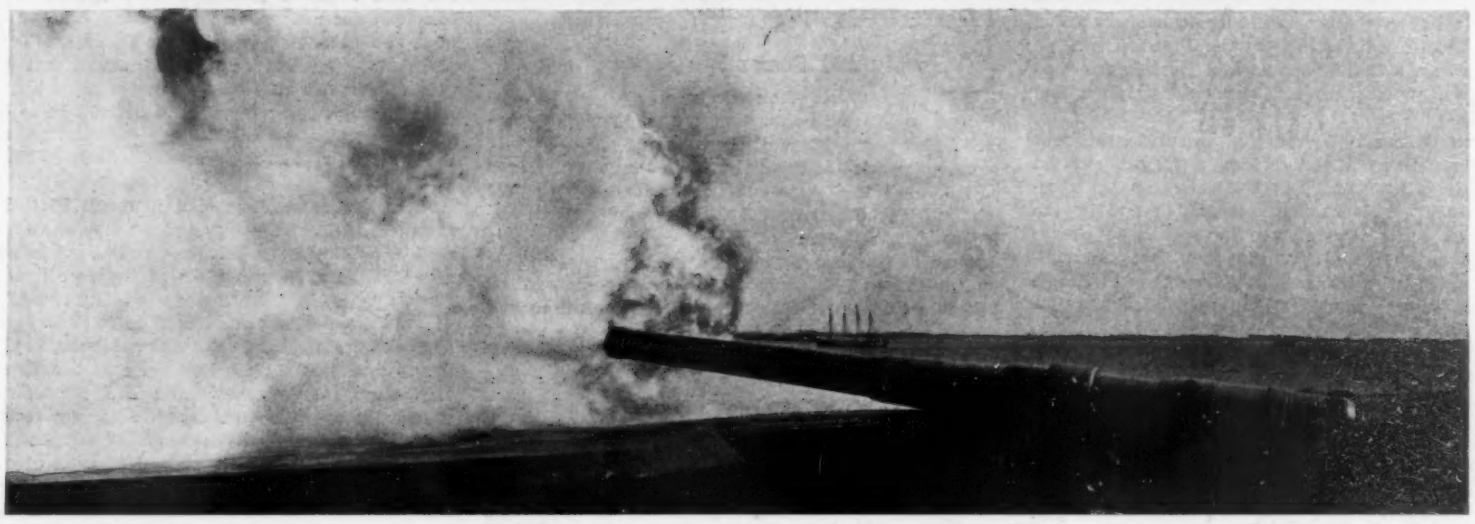

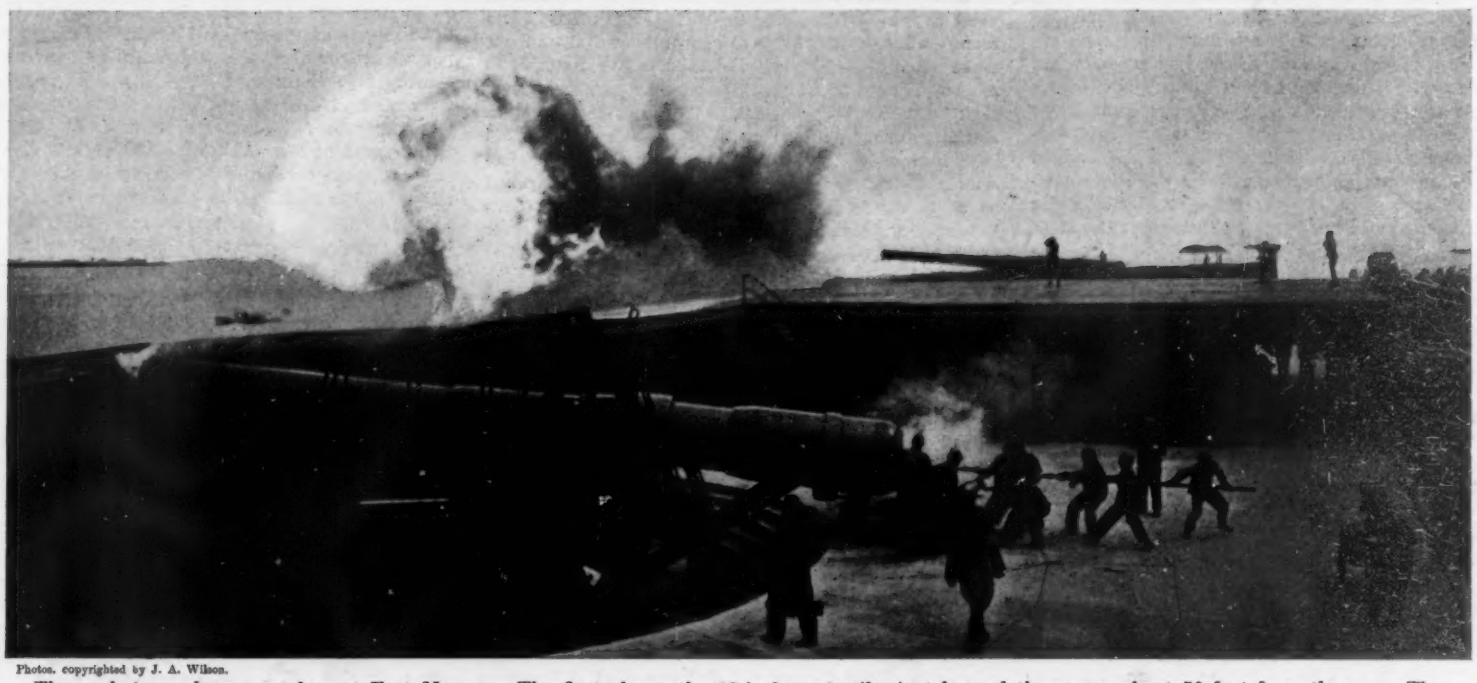

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These photographs were taken at Fort Monroe. The first shows the 12-inch projectile, just beyond the gases, about 50 feet from the gun. The camera was actuated electrically by means of the projectile.

THE DISCHARGE OF 12-INCH GUNS.—[See page 365.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Our Panama Canal Number

FROM the time, some ten or twelve years ago, when the construction of a Trans-Isthmian Canal by the United States began to be seriously considered, the SCIENTIFIC AMERICAN has devoted much attention to this great national enterprise. Mainly on technical grounds, we were an earnest advocate of the construction of this canal at Panama, having foreseen the great engineering difficulties and the subsequent risks of operation which would attend the construction of a canal at Nicaragua. The progress of the work at Panama has been a prominent feature in this journal from the time when the canal was taken over by the United States from the French Construction Company, and this monumental work has formed the subject of frequent illustration, description and comment.

It gives us much pleasure to present in the next issue of the SCIENTIFIC AMERICAN a fully illustrated description of the Panama Canal, written by members of the Isthmian Canal Commission and by the various technical officials who have been in charge of the work. Because of the fact that the articles are written by the men who have been in charge of the work, this number will have particular value, authority, and interest to our readers. Many facts, hitherto unrecorded, relating to the difficulties of construction and the way in which they have been overcome, will be given by the engineers who were on the ground and had to meet the various contingencies as they arose and find a practical solution thereof.

The Panama Canal Number will open with an article by Lieutenant-Colonel Siebert, of the Corps of Engineers U. S. Army, who has had charge of the construction of the great triple-flight locks and the huge dam at Gatun, which constitute in themselves a work of a magnitude unsurpassed in the history of hydraulic engineering. We have all heard much about the great Culebra cut through the mountain divide and of the enormous slides which have developed during the progress of excavation. This subject is handled in a clear and comprehensive way by the army engineer who has been in charge of the Culebra Cut for the last five and one half years, Lieutenant-Colonel D. D. Gaillard. So excellent have been the organization and the efficiency of the plant and methods of excavation and transportation, that, although some twenty-two million cubic yards of slides have come down into the Culebra cut during construction, the total cost of the work will not exceed the preliminary estimate of cost—a record of which Col. Gaillard may very justly be proud.

It is very well understood by everyone who has even thought about the Panama Canal, that its construction would have been impossible but for the fact that the two great scourges of the Isthmus of Panama—yellow fever and malaria—have been either completely exterminated or thoroughly controlled by the Sanitary Department under Col. Gorgas. This subject is treated in a very readable way by Dr. Orenstein, one of the members of the staff under Col. Gorgas.

With the near approach of the opening of the Canal, the question arises as to its future commercial value to the United States. We have been fortunate in securing an article on this subject from a member of the Isthmian Canal Commission, Prof. Emory Johnson, the expert statistician of the canal. Prof. Johnson shows in his article what are the principal trade routes of the world, how they will be affected by the opening of the canal, and what are the reasonable prospects of attracting to the canal a large and paying proportion of this trade.

When the canal is opened, electricity, which during the past two decades has entered so largely into all great constructive work and the operation thereof, will become the all-but-universal motive power in the operation of the great waterway. This subject will be treated in a comprehensive manner by one of the leading engineers in the field of electrical engineering.

A Coming Profession

SO far as our knowledge goes, the city of Sumter, S. C., is justified in claiming that it has introduced "a new and coming profession." Through the secretary of its Chamber of Commerce, that enterprising community of ten thousand people has announced that applications will be received for the office of city manager of Sumter. From the brief summary of the requirements for this office, we gather that the applicant should be competent to oversee public work, such as paving, lighting, water supply, etc., that an engineer would be preferred; that he must state what has been his previous experience in municipal work; that he will have complete administrative control of the city, subject to the approval of a board of three elected commissioners, and that he will hold office so long as he gives satisfaction to the commissioners; that his work will be purely that of an expert; and that he will be entirely free from political control; finally, although local conditions and tradition will be taken into consideration, local citizenship will not be necessary.

The announcement concludes by designating this as "A splendid chance for the right man to make a record in a new and coming profession; since this is the first time that a permanent charter position of this sort has been created in the United States." If the last statement is correct, the SCIENTIFIC AMERICAN congratulates the little city on having inaugurated a movement whose beneficial results in the orderly, economical and righteous administration of municipal affairs will make themselves increasingly apparent.

Supply and Demand in Motor Fuels

THE question of an adequate supply of gasoline for internal combustion engines is again becoming acute. Several times during the past eight months the price of this automobile necessity has been raised, until it now is 60 per cent higher than last winter. The Standard Oil Company, as well as the independent refineries, of course, hold the increasing demand and practically stationary supply responsible; and as the truth of their claims cannot be denied, it behooves the manufacturers interested in motors and motor vehicles to adapt their engines to the use of other hydrocarbons than gasoline.

The suggestion is not new; it has been discussed time and again. Benzol, alcohol and kerosene have been tried and found wanting—in the carbureters used for gasoline engines. The fault was not with the fuels, but with the carbureting devices employed. Excepting for the apparent reluctance of manufacturers of motor cars to provide the small extra equipment necessary to attain this desirable end, there is no reason whatsoever why kerosene or benzol should not make highly satisfactory fuels for the automobile motor. Nearly every gasoline tank has an emergency tank built in. Why could not this tank be used as a starting tank, and the main compartment be filled with kerosene? The carbureter adjustment for kerosene is slight; a mechanical air valve could be attached so as to supply the mixture with more oxygen than is necessary for running with gasoline. The carbureter could be water-jacketed or otherwise warmed, so as to facilitate gasifying of the fuel, as is done in many cases even now.

As one of the officials of the Standard Oil Company recently explained to the writer, the whole trouble with the gasoline supply of this country is not at all in the supply of crude oil, but in the inability of the refiners to get rid of the kerosene and other heavier fuels obtained in the process of distillation. When kerosene was used in households to a much greater extent than at present, the gasoline—then an almost useless by-product—was sold at ridiculously low prices. Now the positions are reversed; gasoline sells for a high price because it finds a ready market at any time, while kerosene is the by-product. The moment that manufacturers of carbureters and motor cars learn to use both fuels interchangeably—gasoline for the first few miles, and then, when the motor is warmed, kerosene—the price of the former will fall and that of kerosene rise. The increase in price of the latter fuel, however, need not worry the motorist, for kerosene is more economical and satisfactory in many ways than gasoline. And should the "oil trust" and the independents feel inclined to still further raise the prices of both gasoline and kerosene, there is enough coal tar made in this country to supply fully one half of the motor fuel demand with the coal tar distillate—benzol (benzene). The matter lies entirely with the manufacturers of carbureting devices and cars.

Achievements in Aviation

THE winning of the International Cup Race at Chicago two months ago by Vedrines at an average speed of 105 miles an hour, and the making of a single circuit of the 4.14 mile course at 108.05 miles, was but one of the astounding performances accomplished of late by Frenchmen in the field of aviation.

Besides the remarkable long distance flights from Paris to Berlin and from Antwerp to Paris that have been made by Frenchmen, they have set up other remarkable distance, duration and altitude records. The most noteworthy distance and duration record was made by Alexander Fourny, chief instructor of the Maurice Farman School at Buc. Fourny was the holder of the duration record—11 hours 2 minutes and 29 seconds—for the past year, but not of the distance record for a non-stop flight above an aerodrome, as this—461 miles—was made by Gobé on a fast Nieuport monoplane last year. On September 11th Fourny set out to break both records, and he succeeded despite violent squalls and showers which hindered him throughout the day. Starting at 5:53 A. M. with 71 gallons of gasoline in his tanks, Fourny circled the aerodrome at Etampes continuously for 13 hours and 22 minutes, covering a distance of 1,017 kilometers (631.93 miles) at an average speed of 47.27 miles an hour. When he descended darkness had fallen. For an hour before he landed it was necessary to light and maintain fires at different points along the course in order to guide this enduring aviator.

With a 160 horse-power monoplane similar to Vedrines' Deperdussin (which was of but 140 horsepower) it would take only three fifths of the time that Fourny remained aloft to fly from New York to Chicago. In other words, ten hours could be cut from the time required by our fastest express trains to run from one metropolis to the other. The production of such a commercial machine is a comparatively simple matter. In fact, Vedrines has stated that were he able to come to this country and remain here for a time, the first thing he would do would be to develop a commercial speed monoplane and start an air line for passenger traffic between the above mentioned cities.

After having constructed a powerful Blériot monoplane especially for quick climbing, Roland Garros succeeded, on September 6th, in breaking all records for altitude. In an hour and a half he rose to a height of 4,900 meters (16,076 feet) surpassing by 630 meters (2,067 feet) the previous record made by the Austrian army officer, Blaschke. But Garros's enjoyment of his new record was not for long, as only five days later, the intrepid Legagneaux, who had previously done practically no high climbing in any way comparable with Garros's, reached the stupendous height of 17,880 feet (5,450 meters)—over 3½ miles in the exceedingly short time of 45 minutes, and dropped from far above the clouds to *terra firma* again in 10 minutes. He used a Morane-Saulnier monoplane and climbed the first 1,000 meters at the unheard of rate of over 1,300 feet per minute, or about fourteen miles an hour vertically—over three times as fast as any monoplane, except Garros's had ever been known to climb before. The climbing rate fell proportionately as the air became lighter, and at the end of their ascents both aviators had to inhale oxygen. In Garros's case the gas gave out at 13,125 feet, and he climbed the remaining 2,951 feet without it. At the tremendous height attained by Legagneaux—greater by 4,000 feet than that of Pike's Peak—the atmospheric pressure is only about half that obtaining at sea level. Not alone the aviator, but his motor as well, become starved for oxygen; and it is surprising that the latter can develop enough power to reach so great an elevation. Undoubtedly, by feeding oxygen to the motor as well as to the aviator, even greater heights can be attained.

Action of Shrimp on Tin

THE popular idea that only acid substances attack tin is wrong. Fish, asparagus, beans, pumpkin and spinach are not acid and yet their corrosion of tin is quite marked. This is probably due to amino compounds, substances related to ammonia. In the case of shrimp, the cans are often eaten through in a comparatively short time. So alkaline is the methylamine contained in the shrimp that workmen in the canneries find the skin peeling off their hands and their shoes eaten through. Shrewd observation by some canners led to the discovery that if the shrimp were iced for a day before canning the corrosive action of the juices was greatly diminished. This is now the universal practice. In addition the cans are lined with paper to prevent contact of shrimp and tin.

Electricity

Treatment of Sulphated Storage Battery Plates.—A new electrolytic method of regenerating accumulator plates that have been injured by "sulphating" is announced. The plates are immersed in a sodium sulphate solution, making an electrolytic cell through which current is passed, forming sodium hydroxide in the negative plates and sulphuric acid in the positives.

The Production and Consumption of Copper.—It is calculated that the consumption of copper runs parallel to that of iron, and statistics show that the world's use of the so-called "red metal" ranges from 334,565 tons for America (the chief consumer) down through Germany, Great Britain, France, Austria-Hungary, Russia and Italy to 42,000 tons "for other countries." The production has about tripled in the last twenty years.

New Plant for Making Aluminium.—Aluminium is to be turned out at the rate of 25,000 tons annually at a new hydro-electric manufactory now under construction in North Carolina. Power will be supplied by seven vertical water-wheel type electric generators of 5,000-kilowatt capacity, the largest ever built for generating direct current, together with several smaller machines. The enterprise has been financed in France and the work is in charge of Dr. R. Heroult. The plant will be the largest in the country, except one at Niagara Falls, and it will be completed by the middle of 1914.

Enamel as a Dielectric for Wireless Telephone Condensers.—A Japanese invention is announced designed to overcome the well-known electrical and mechanical difficulties experienced in the use of glass-plate condensers in wireless telegraphy, especially on board ship. Brush discharge at the edges of the glass plates, which is ordinarily reduced by varnishing at the edges of the plates, is more effectively checked by a flexible, non-splitting coating of enamel of high insulation resistance and dielectric strength. In Leyden jars the loss from brush discharge was reduced nearly 20 per cent by the use of the enamel.

Cadmium Alloy Vapor Light.—Many attempts have been made to improve the mercury vapor lamp, which gives a light of high electrical efficiency but is disadvantageous for some purposes on account of the greenish color of its light. A German inventor now announces two forms of metal-vapor lamp giving a white light by an alloy of cadmium with a small percentage of mercury. One form has a graphite anode and a mercury and cadmium cathode, and the other has both electrodes of the cadmium and mercury. The latter lamp is claimed to have an efficiency equal to that of the pure mercury vapor lamp. A peculiarity of the new lamp is that the active material, being solid at ordinary temperatures, becomes deposited on the walls of the quartz tube as the lamp cools after the current is turned off. This action gives no trouble, however, as the deposit is vaporized as soon as the current is switched on again.

Power Dissipating Rheostat.—The dissipation of large amounts of energy in electrical testing work by means of rheostats becomes a serious problem on account of the heat generated, and special means of cooling the rheostat must be provided. For testing a large storage battery at St. Louis, requiring the continuous dissipation of 1,500,000 watts of energy, the device was adopted of using iron pipe as the resistance conductor and of cooling the same by circulating water through the pipe. A total length of 369 feet of 2-inch pipe was used, made up into a grid which was tapped at several points to allow the water to escape without having to pass from end to end of the grid. In the use of this rheostat the 5,100-ampere discharge of the battery was satisfactorily dissipated during the rated one-hour discharge by 1,310 cubic feet of circulating water, although it was found necessary to quench local hot spots in the pipe by playing on them with a hose.

Load Dispatching on a Great Central Station System.—In certain large and complex electricity supply systems, where current generating capacity is so great that serious damage might easily follow a mistake in closing switches or in making feeder connections, a "load dispatcher" is employed. This official has in his office a large plug panel or board representing diagrammatically the entire generating and distribution system, every high tens.on (oil) switch, feeder and tie line being shown "in little" so that the dispatcher can follow out any given circuit easily and quickly. The pilot lamps on the oil switches (a red lamp for a closed switch and a green lamp for an open switch) are represented on this board by plugs with correspondingly colored heads, inserted in holes to indicate the actual condition of the switches at any moment. No switch is allowed to be operated at any station or substation without telephone instructions from the dispatcher, and upon the information and orders thus communicated, the plugs are inserted and withdrawn in the board. Thus the board shows the electrical condition of the entire system at a glance, thereby enormously facilitating the proper balancing of the load and the quick location and removal of trouble.

Science

The Cinematograph in German Schools.—The German Ministry of Education proposes to introduce the use of the cinematograph in various courses at institutions of higher education. Films for courses in anatomy biology and bacteriology are already available in Germany. A leading philanthropist has presented two fully equipped moving-picture machines to the schools of Berlin, one of which is to be used in the higher normal schools and the other in the high schools.

Schaumasse's Comet.—The new comet discovered by Schaumasse of Nice, France, on October 18th, was discovered independently by Dr. W. R. Brooks of Geneva, N. Y., on October 20th. A cablegram from Kiel states that Fayet and Schaumasse announce that the elements of the comet are nearly identical with those of Tuttle's comet, discovered January 4th, 1858, at Harvard College Observatory, and later shown to be identical with Mechain's comet, 1790, II. Its period is about fourteen years. It was observed in 1871, 1885, and 1899.

British Gasoline Fire Tests.—The British Fire Prevention Committee, at the opening of its autumn session last month, carried out a highly important and interesting series of experiments with a foam extinguisher. The foam, which is created by chemical means, was thrown upon burning gasoline, ranging in quantity from a mere bucketful to a flooded basement in which fifty gallons had been spilled. The tests are said to have been highly satisfactory and were watched by representatives from the several government departments. Members of the military aviation department also were present.

Rev. Walter William Skeat, who died on October 7th, was a tower of strength in English philology, and his place will not soon be filled. To the average man he is probably best known as the author of an Etymological English Dictionary, which is found in all libraries, but during his life of 77 years he produced a prodigious number of other valuable works, nearly all relating to the English language, past and present. He edited many old English texts, and he was the founder and first president of the English Dialect Society. From 1878 to the time of his death he was Professor of Anglo-Saxon at Cambridge University.

A Statue of Capt. James Cook, the navigator, the gift of the Hon. Gervase Beckett, M.P., to the town of Whitby, was unveiled at that place October 2nd. In referring to this event the English journal *Nature* reminds its readers of the fact that Cook earned the gratitude of the world not alone as an explorer, but also as the first person to take scientific preventive measures against scurvy on shipboard. In so doing he contributed greatly to the success of nautical explorers who came after him. When he returned from a three years' voyage in 1775, he had lost but one man in a crew of 118. This achievement earned him unanimous election as a fellow of the Royal Society.

Capt. Koch's Journey Across Greenland, the plans for which we have previously reported, was successfully begun during the past summer. A remarkable bit of preliminary training was carried out by the party, which while visiting Iceland in its ship, the "Godthaab," in order to procure Iceland ponies for the sledge journey, made a brilliant dash across the island, from south to north, scaling the highest point of the inland ice-cap, viz., Oræfajökull, a feat which had been accomplished only once before, by Lord Watts, in 1875. The party sailed north from Akureyri, Iceland, on July 6th, and effected an easy landing at Cape Bismarck, on the far northeastern coast of Greenland, July 21st. This would have been impossible in the summer of 1911, when the ice conditions were very unfavorable. Capt. Koch expects to cross Greenland at its widest part, reaching the west coast some time next year He is accompanied by the German meteorologist, Dr. Alfred Wegener.

The Northeast Passage.—No less than three expeditions are now under way, or in preparation, with the object of making the Northeast Passage around the Arctic coasts of Eurasia; a feat that has not been accomplished since Nordenskjöld's successful journey of 1878-79 in the "Vega." Two of them have already been reported in these columns, viz., that of the two Russian ice-breakers, which were to sail from Vladivostok last summer. and the elaborate German expedition under Lieut. Schröder-Strange, which is to leave from the European side in June, 1913, and spend about four years in explorations *en route*. It is now stated in *Petermann's Mitteilungen* that a Russian expedition under Lieut. George Brussilov left St. Petersburg in July in the "St. Anna," which under the name "Pandora" was the vessel used by Sir Allen Young in his journey of 1875-76 in quest of traces of Sir John Franklin's expedition. Brussilov will follow the route taken by Nordenskjöld, and expects to reach Vladivostok in about a year and a half. The expedition proposes to winter at the mouth of one of the Siberian rivers; probably Khatanga. It is expected to defray part of the expenses of the expedition by hunting and fishing and by trade with the natives.

Automobile

Self-illuminating Car Paint.—The latest in automobile paints comes from England. One of the largest firms there has just brought out a new varnish, called "Lumino Aluminium Paint," and it is stated that the glow of the paint on a dark night is so bright that the car is visible for two miles, without being fitted with lamps. People on the roads near the factory at first were frightened to death by the strangely glowing, lightless cars, which silently skimmed through the village.

Eight Patents for Hinged Vehicle Hoods.—Traugott Golde has secured patents numbered from 1,034,899 to 1,034,906, inclusive, for hinged vehicle hoods comprising an arrangement of bows for supporting a hood or top of the automobile type in such manner that the tops are supported from the rear portion of a car and extend thence forwardly over the front seat. In the earlier filed applications Mr. Golde appears as from Gera, Germany, while in the later applications his address is given as Passaic, N. J.

Armor-plated Cars for Italy.—The Milan automobile club has opened a subscription to provide the war department with armor-plated automobiles for the operations in the Tripoli region, and these are to be made according to a special design, carrying light cannon and also mitrailleuses. Engineer G. Galli has now gone to Tripoli in order to organize the automobile service, as there are now considerable funds received, so that it is expected that the armored cars will soon be crossing the desert, manned by the best officers of the engineer and artillery corps.

Handy Combination Lamp.—A combination automobile headlight and movable hand lamp has just been placed on the market. It consists of a silver-aluminium casting about 3/16 of an inch in thickness, ground on the inner surface to a mirror-like polish. The socket of the electric lamp fits in the reflector in such a manner as to be easily removable by a simple turn of the socket to the left. The long flexible cord attached to the socket renders it available as a "trouble lamp" reaching to all parts of the car. The removable socket also permits of using varipowered bulbs for use in city and country driving.

Montreal Forbids Steam Trucks.—At a time when renewed effort is being concentrated on a sturdy powerful steam truck, which has been demonstrated in Detroit and in Nyack, N. Y., the city of Montreal, Can., is making an attempt to legislate the steam truck and tractor out of business. The city council has just passed an ordinance forbidding the use of steam-propelled commercial cars on the streets, but permits the driving of steam-propelled pleasure automobiles. The ordinance is particularly aimed at the huge steam tractors with their trailers, which are used in England and which are in evidence in the country districts of Eastern Canada.

Trouble With Initials.—Considerable trouble is experienced in Europe with the custom of abbreviating the extraordinarily long names of some of the cars, by using the initials only. There is a S. C. A. R. car made in France, a S. C. A. T. in Italy, and a S. C. A. P. also made in France, the initials in each case representing "Société de Construction Automobile" (then follows the last word: Turino, Parisienne, or whatever it may be). The newspapers and magazines, especially, are "up in the air," frequently giving credit to the wrong car, and even perpetrating errors in the advertisements put out by the various companies.

How They Do It in Germany.—In educating police magistrates and prosecuting attorneys in the rudiments of automobile traffic requirements, so that they may be able to handle intelligently the many cases of traffic violations, the Berlin justices of the lower courts and their "Staatsanwaelte" were taken on a tour of the city in automobiles supplied by the Imperial and Berlin Automobile Clubs. During this tour, which lasted several days, and which penetrated into every section of the big city, the cars were driven at all rates of speed and the passengers were given all opportunities to test in their own persons the effects of Berlin's traffic regulations.

Carbureter Attachment for Slow Engine Speeds.—An English firm has just brought out a carbureter attachment which will enable the chauffeur to keep the engine running, while the car is standing still, at an exceedingly small expense for gasoline. The device consists of a small fitting, containing a minute jet and air inlet soldered to the inlet pipe, between carbureter and engine, and a small pipe connecting with the float chamber. An adjustable needle valve is supplied to adjust the quantity of gas and air required for slow and silent running. The action of the device is entirely automatic. On shutting the main throttle, the vacuum in the inlet pipe increases to such an extent that the small auxiliary jet comes into operation, the gas mixture being regulated by the position of the needle valve. When the throttle is opened again, the suction decreases and no gasoline is drawn up to the auxiliary jet, which is at a higher level than the main jet.

Electricity and Spray Irrigation

How Water May be Raised by Electric Pumps to Produce Artificial Rain

By Putnam A. Bates, E.E.

ELECTRICITY for lighting and power is rapidly advancing in the favor of the American farmer. Whether he be one of those adventurous individuals who stake their all on the prospect of developing a paying farm in the arid districts of the West and Southwest, or in the swamplands of the South, or whether he be of the class that is turning its attention to the great rewards of truck and dairy farming in the East, the modern farmer has caught the scientific spirit of the time and is getting practical results from his realization of the fact that methods must accommodate themselves to changing conditions.

At Bridgeton, New Jersey, Charles F. Seabrook is farming with twenty-five acres under irrigation, and he usually gets from three to four crops a year from each piece of ground. The crops raised are lettuce, celery, parsley, carrots, cabbage, beets, onions, leek, and practically every kind of truck a vegetable gardener would grow.

The method of irrigation which Mr. Seabrook employs is shown in Fig. 1. While not new, it is quite different from the methods with which we are more familiar, that have become so stamped upon the mind of many not especially posted as to lead them to regard water "ditches" and "irrigation" as indicating synonymous conditions. The idea is to reproduce a gentle rainfall, insuring uniform distribution of water, under control. The application of the water is in the form of a fine spray, which settles into the soil, and does not remain on the surface. The pipes run horizontally across the field six feet in the air and are fifty feet apart. Every four feet a nozzle is inserted in the pipe from which the water is ejected in a fine spray. This spray is so fine that it does not pack the soil as a heavy rain.

It is a noteworthy fact that for every pound of solid matter added to a plant by growth, it is necessary that several hundred pounds of water be taken up by the plant and evaporated through it into the atmosphere. That indicates the importance of the proper means of furnishing the water supply to the plant. With this fact in mind, it is impossible to understand the reason why the crops secured from proper irrigation yield results which seem unbelievable to many growers.

The difficulties encountered in many methods of irrigation are: the initial cost of installation, the difficulty of securing a satisfactory uniformity of distribution, the waste of water and the excessive labor and expense involved in irrigation.

The most familiar method of irrigating a considerable area is the ditch system. In many localities the character of the soil renders the use of the system impossible but, wherever used, it is wasteful in the use of water. And with this system it is difficult to approach that uniformity of water distribution necessary to produce an equal growth on all parts of the acreage irrigated. The cost of labor involved in this method is high, and should a heavy rainfall follow the irrigating damage is apt to result. What is known as the deluge "system" is an overhead distribution system sometimes used, in which circular lawn sprinklers are located at regular distances over the field, the water being supplied to them by pipes. The objections to this method have been two-fold. First, it is impossible to secure a uniform distribution of the water, for the reason that between the circular areas watered by the sprinkler there exist dry spots which do not receive a sufficient amount of water. The second objection is that the water as applied to the ground has the same effect on the surface soil as does a heavy rainfall, resulting in heavy incrustation of the surface, interfering with the air supplied to the roots of the plant, thus retarding the growth, and necessitating additional cultivation. The expense of this system in its first installation is excessive and the results are unsatisfactory.

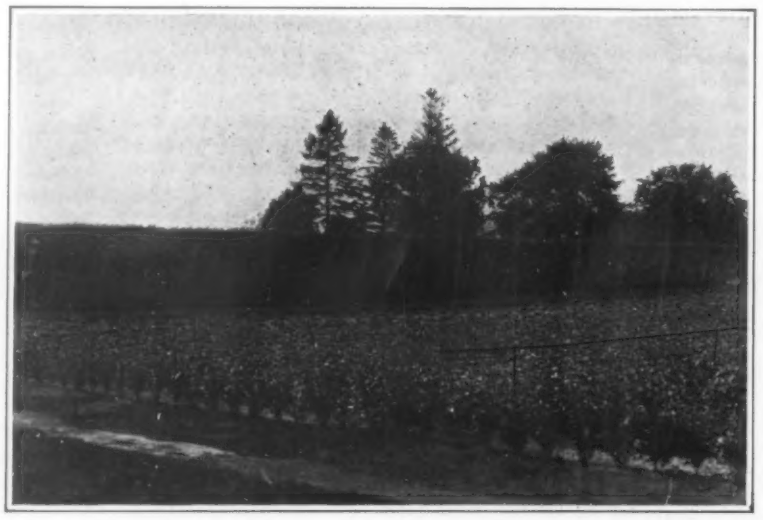


Fig. 1.—Irrigation in the form of an artificial shower.

On small areas the makeshift method of watering by hose is used with reasonably good results, but it is only a makeshift and requires too great a labor cost to be considered for anything more than a small patch.

It is impossible, therefore, to water uniformly and without materially disturbing the proper mechanical condition of the surface soil unless we follow a method the application of which will approach the conditions under which a gentle rain or mist will fall upon the ground. The method which is here shown accomplishes this, and it is without question beneficial in truck garden work or on other areas of fertile soil where the forcing of crop growth is undertaken.

In the kind of farming that is being taught to-day we must plan for a full crop every year—not every other year, or, every third or fourth year, as so often happens in the humid sections where the land is neither drained nor artificially watered, but where thirty to sixty-day droughts occur with considerable regularity.

There is so much comparatively inexpensive land surrounding all our large cities that it is well to lay stress on the methods by which such areas may be made more productive.

On a demonstration plot where the spray irrigation was employed an acre and a half of this farmer's strawberries yielded over $200 worth of fruit after non-irrigated ones in the same field had ceased to bear for the season.

Irrigated onions yielded at the rate of 482.8 bushels per acre, the bulbs taking first premium at the fair for quality. This onion crop received during its growth 3.04 inches of water by irrigation and 5.77 inches by rainfall. But the rainfall failed to do its duty, as the bulk of it came in one large cold storm and the balance in eleven small useless showers. Irrigated raspberries responded with a ten days' longer bearing season, and much more thrifty canes than non-irrigated vines. The manner in which the water shall be conveyed from its source-stream, pond or underground flow, to the distribution system adopted is a problem that merits as careful analysis as that applied to the question of spreading water upon land.

In any case pumping is an essential except where nature provides conditions of gravity flow. The usual gasoline engine-driven pumping equipment is shown in Fig. 2. Oftentimes it is necessary to use an internal-combustion engine for irrigation pumping, but in the last analysis, where electricity is available the motor-driven pump offers, in ease of control and convenience of application, the best conditions yet devised.

Fig. 3 shows a small electric irrigation pump, and with such it is possible to introduce in the installation a storage tank under air pressure which will supply the water through the system of overhead sprayers at a desired "head," and at the same time the operation of the electric motor may be entirely automatic, no attention whatever being required for either stopping or starting. And from an entirely different point the water supply to the distribution system may be controlled or regulated according to the needs of the crops which are under irrigation. Lastly, on a basis of reasonable cost for electric current, pumping by means of this form of energy is cheaper than with any other.

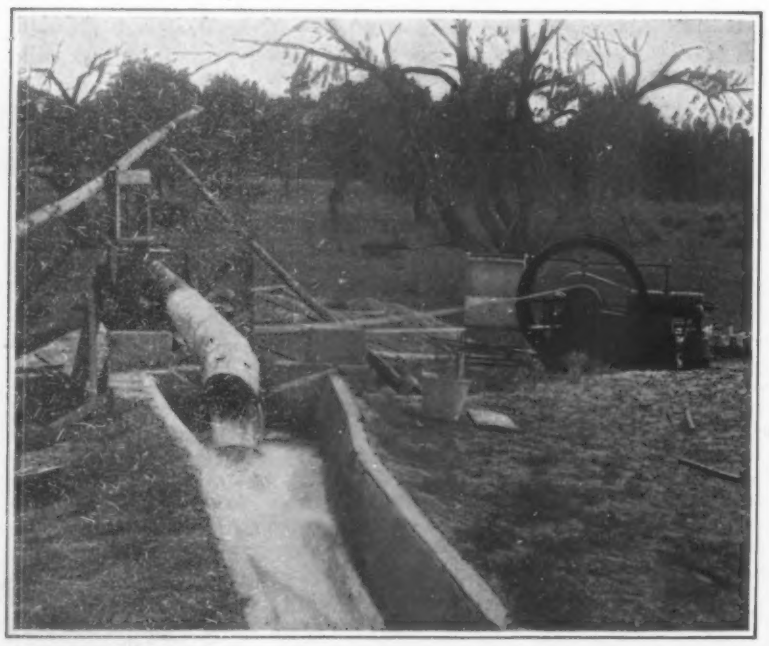


Fig. 2.—Where electricity is out of the question a gasoline motor will pump water for irrigation.

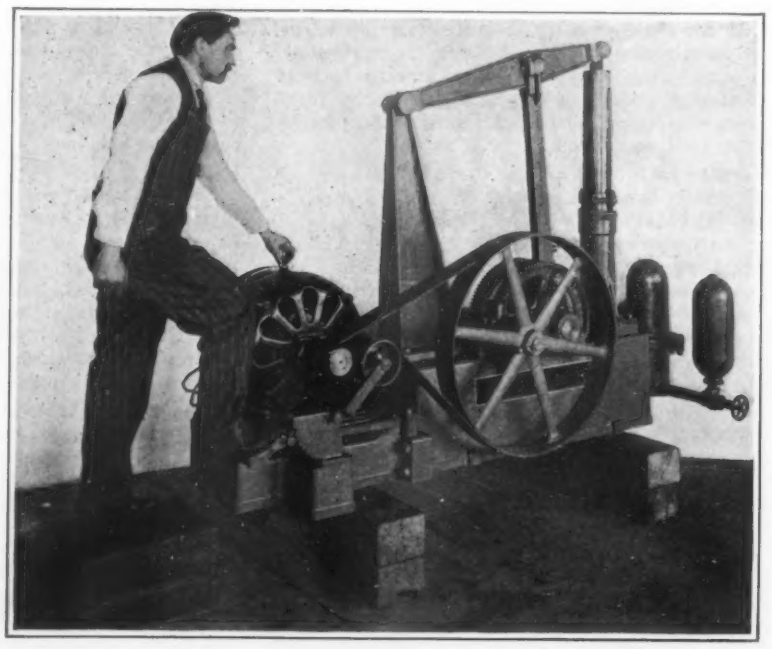


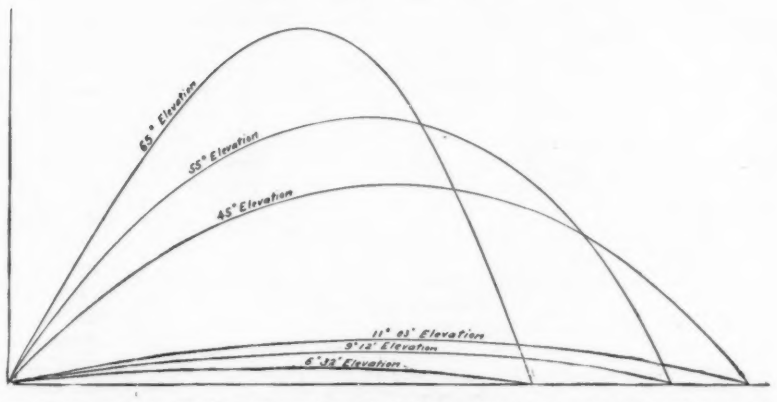
Fig. 3.—Combined electric motor and pump controlled automatically or by switch at distant point.

Mortar Fire

A System for Attacking the Decks of Battleships

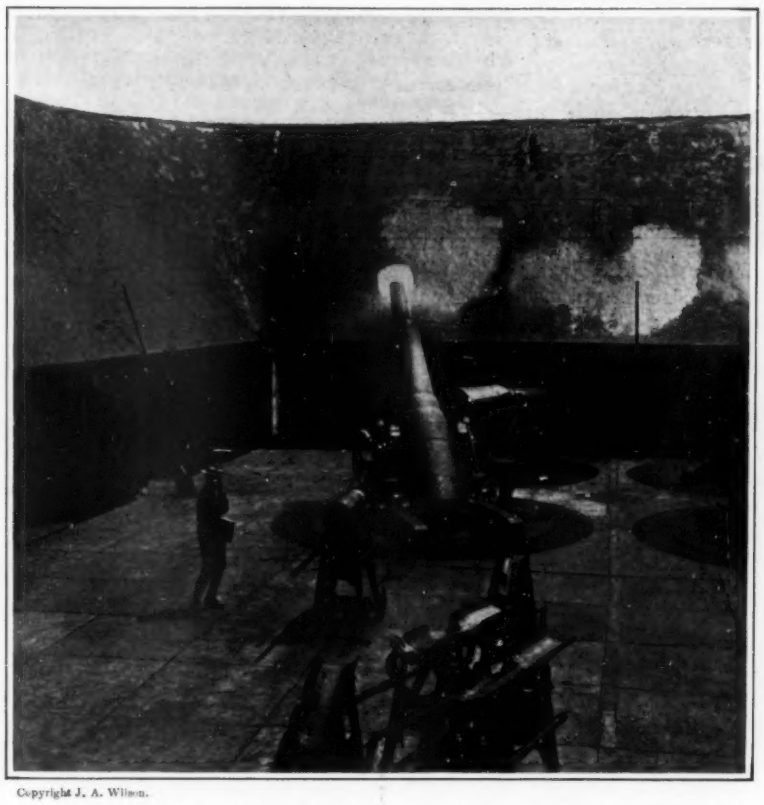
By Charles A. Junken

FIRING directly at the side of a large wooden box at fifty yards, even a poor shot might expect a hit. On the other hand, an expert rifleman, with equal certainty, might expect to miss, firing in the air, in an effort to land on top of the box. In any event the latter method of attack would hardly appeal to a sportsman. Far better to try for an almost sure hit firing directly at the side of the box than to take chances on an equally sure miss in an attempt to hit the lid by firing in the air; and in so far as mere hitting is concerned no question can be raised as to the better method of attack. Suppose, however, that it is essential not only to hit, but perforate, the box which is now to be considered so far removed that a side



Relative angles of elevation and trajectories of shells from 12-inch rifles and mortars.

tance of flight of any object launched in air, under similar conditions, depends entirely on the angle of elevation. The propellant force remaining constant and conditions normal, the range depends solely on the angle of elevation at which the given object is projected. This is alike true of a baseball thrown by an equally strong arm, a football punted by an equally strong leg, or a bullet of certain dimensions and weight propelled at equal velocity from a firearm. For any given set of conditions an angle of projection of about forty-four degrees and twenty minutes will result in the greatest possible range. Roughly speaking, this is an angle of forty-five degrees, and this angle is adopted as the lower limit of elevation for mortar fire.



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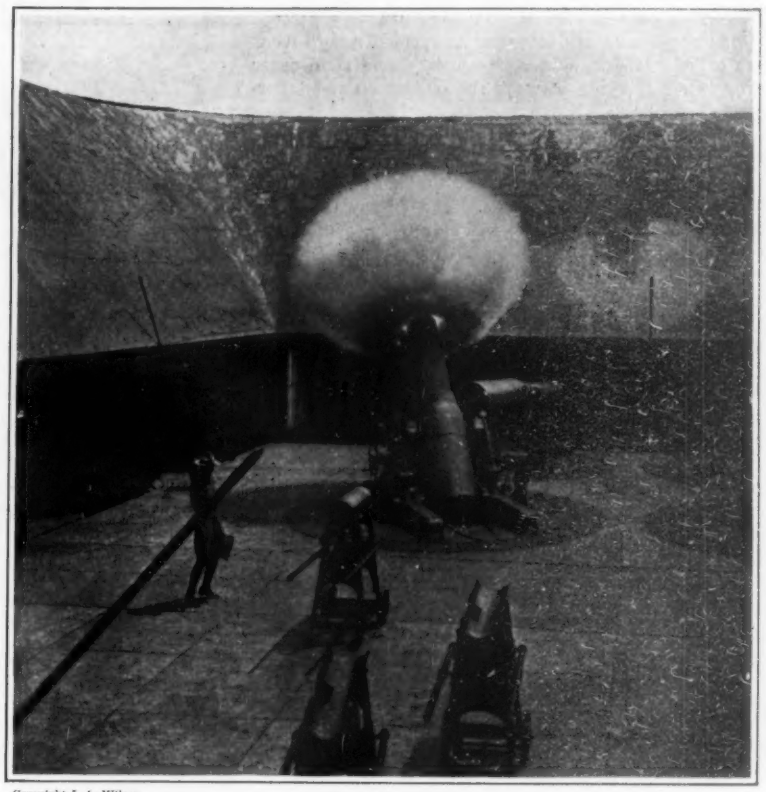
Photograph, 1/5,000 second exposure, showing shell issuing from mortar. The white ring is gases that have escaped past projectile in the bore.



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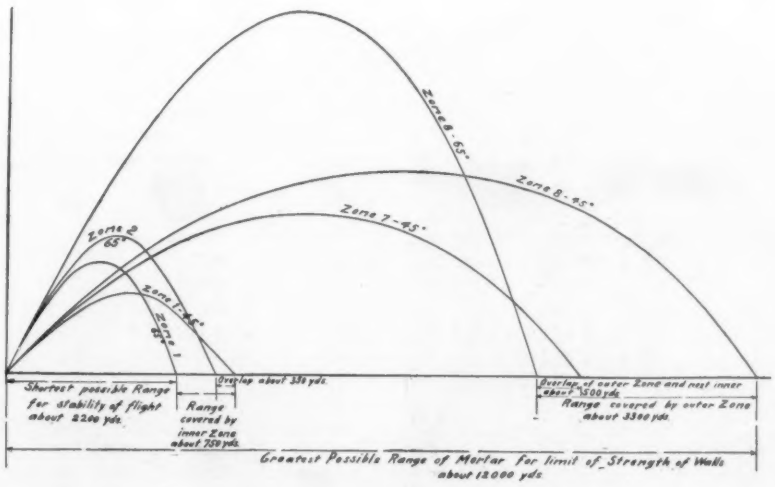
The mushroom-like burst of gases from muzzle immediately after the shell has left the mortar. Taken an instant later than adjoining photo.

sheathing of metal results in the flattening out of all bullets fired directly at it. The top and bottom of the box remaining unprotected, the lid offers the only hope of successful attack. The rifleman is thus forced to resort to a method known as "indirect" or "high angle" fire as the only chance of successful attack.

The box thus described is an illustration of the target presented by a modern battleship or heavily armored cruiser. In broadside this is so heavily sheathed with protecting armor as to be well nigh invulnerable, at even moderate ranges, to the attack of the most powerful modern "direct-fire" guns. In deck armor it is rather weak and entirely at the mercy of the "indirect" fire of a modern mortar. The relative thickness of side and deck armor is illustrated on the next page.


Zone 8 65°
Zone 8-45°
Zone 7-45°
Zone 8 65°
Zone 7-45°
Zone 7 65°
Shortest possible Range for stability of flight about 2200 yds.
Overlap about 335 yds.
Range covered by inner Zone about 750 yds.
Overlap of outer Zone and next inner about 1500 yds.
Range covered by outer Zone about 3300 yds.
Greatest Possible Range of Mortar for limit of Strength of Walls about 12000 yds.

Zones of fire of mortar batteries.

Because of the only remaining chance of successful attack the mortar advocate will obtain a most respectful hearing if he can but develop a tendency to hit. If it be required of him, he can plead the additional argument of economy. Owing to the weak deck armor he is called upon to perforate, his gun is short, for he requires but low velocity to attain long ranges. Projectiles are big because the walls of the mortar can be handily made thick and strong enough to withstand the pressures developed by the relatively small powder charge required to launch a big projectile to a considerable range, and the very fact that small charges of powder are required, makes for economy in every round. The relative sizes of guns, projectiles and powder charges are herewith illustrated. The ranging effect or dis-

Both above and below this angle of projection the range decreases till, on the one hand at dead level, and on the other at the vertical, the range becomes zero. This is illustrated in the paths of flight herewith shown. From the dead level or zero elevation to forty-five degrees, every possible range within the power of the firearm is attainable, and the same is equally true from forty-five degrees elevation to the vertical. But the theoretical possibilities thus developed are vastly prescribed in practice. As has been pointed out, direct-fire guns are limited to the range at which their projectiles can perforate heavy side armor. At the comparatively low angle of fifteen degrees this limitation is reached, even at normal impact, which is, of course, quite exceptional, since it means a flat broadside exposed to attack, which rarely happens.

At present writing it is well assured that the best armor-piercing shot fired from the most effective direct-fire gun is impotent on the present side armor at ranges consequent on angles of elevation about fifteen degrees. The velocity is so greatly reduced by the resistance of the air that the remaining momentum of the projectile merely serves to shatter it helplessly against the heavy side armor of the target. Direct fire has to-day a sure limitation

of fifteen degrees, and will have for some time to come. The limiting angle for indirect fire or mortar fire is likewise restricted, but from a very different cause.

At angles of elevation above sixty-five degrees the time of flight becomes so great as to be prohibitive, and this marks the limit for the highest angle of mortar fire. There are other considerations involved in the strength of carriage and irregularities of flight above this angle, but these are subordinate to the unavoidable objection of excessive time of flight.

Of course, it is understood that to make a hit, it is essential that moving target and flying projectile arrive at the same spot at the same instant. In firing at a maneuvering battleship the element of time of flight thus becomes a most important factor, and it will be readily admitted that the time the projectile is in the air should not exceed one minute. By changing course and rate of speed, the commander of a maneuvering ship, in such a long interval of time as this, can readily place her at other than the predicted or anticipated point where she is expected to be when the shot strikes. This limit points, at the outer range, to an angle of projection not exceeding sixty-five degrees, since at this angle it takes the projectile over a minute to perform its path of flight.

It is a peculiar coincidence that with limiting restrictions so widely divergent, the scope of angles of projection is about the same. The total change in elevation for direct fire is limited to fifteen degrees, and that for mortar fire to twenty degrees. These limitations of the upper angle thus prescribed place a great restriction on the attaina range. On this account it has been necessary to resort in mortar fire to what are called "zones." It is, of course, essential to cover every yard of range between the outermost and innermost limits of fire.

At a maximum velocity, within the power of the gun, behind a given projectile, the maximum range is attained at forty-five degrees, but the minimum is not attained at sixty-five degrees. The only way to get less range after this angle is arrived at is either to reduce the powder charge or increase the weight of the projectile, or both.

Since the longest ranges are of little value, on account of the inherent inaccuracies, it was decided in Uncle Sam's service to build a mortar only strong enough to carry the heaviest projectiles to moderate ranges. A comparatively light projectile was designed for the outermost zone. With this projectile a certain portion of the total range is covered. The limits of this lighter projectile of 824 pounds weight are between a maximum of about 12,000 yards for forty-five degrees, to a minimum of about 8,700 yards at sixty-five degrees elevation.

An approaching battleship is fired upon by mortars at the outermost range, and finally arrives at safe anchorage on account of the limiting angle of sixty-five degrees elevation, which results in the shortest possible range for the mortar under the restriction formerly adverted to. Alive to this situation, the mortar man employs a heavier projectile of 1,046 pounds weight, the same as that used in a 12-inch direct-fire gun; and so reduces his powder charge as to attain the same or but slightly greater range at his best angle of forty-five degrees with this projectile than was previously attained at sixty-five degrees elevation with the lighter one. He thus establishes a second zone of fire that will last him till the enemy once more arrives at the angle of safe anchorage, as it may be called, of sixty-five degrees. Once again the powder charge is reduced so that the angle of forty-five degrees will result in range but little greater than was previously attained at sixty-five degrees. So on, by successive reductions of charge, the range is shortened with successive zones of fire till the minimum limit is reached.

The limiting range is for an angle of sixty-five degrees with the smallest powder charge that will result in stability of flight. Stability of flight means that in spite of the low limit of velocity and the limiting twist of the rifling of the bore of the mortar, for high velocity, the gyroscopic action of the elongated projectile shall still be sufficient to keep it steady in flight. The wobbling of a spinning top that is dying out is an illustration of the effect that a too low velocity might have on a projectile fired from a gun. There is danger of the projectile "tumbling."

To give the mortar crew time to change the powder charge from one zone to the next, a certain "overlap" of zones is provided. The next lower powder charge is so prescribed that at forty-five degrees elevation the range will be somewhat greater than the charge next above at sixty-five degrees. To meet all these requirements, eight zones of fire are prescribed and the conditions met are herewith illustrated.

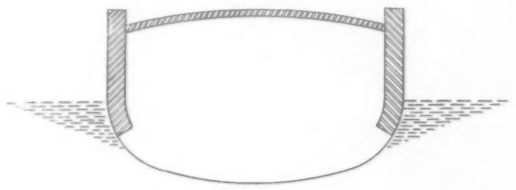
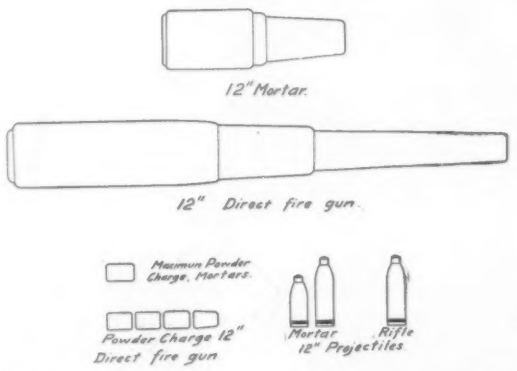


Diagram showing relative thickness and position of side and deck armor.



Relative sizes of direct and indirect-fire guns, powder charges and shells.

With such complications involved, and in consideration of the fact that the mortar crew is hid behind protecting parapets and does not even see the moving target attacked, results are marvelous. A mortar crew in recent firings obtained seven hits in eight shots at a range approximately 10,000 yards, or nearly six miles. That all difficulties have been met and overcome, in the construction of a range table and adequate method of correction for abnormal conditions of atmosphere, wind, and travel of the target, that will give a mortar crew a fair chance of a hit, is an achievement in which the servants of Uncle Sam, who are responsible for this accomplishment, find a solid degree of satisfaction. In no foreign country has so great a measure of success been attained by the methods of mortar fire.

The accompanying photographs are most interesting illustrations of firing by methods of direct and indirect fire. The principal interest attaches, however, to those in which the projectiles have been caught in flight. In the direct-fire picture the projectile is plainly visible, just beyond the expanding gases of combustion, flying forward at the slight angle of elevation requisite to give it the long range it will attain before it strikes. The mortar projectile is shown at the instant before its exit from the bore. The clouded ring that partially envelops the projectile is the result of a slight escape of gas beyond the projectile before it was fairly seated in the rifling of the bore. The next photograph shows what happened an instant later in a later round.

These photographs were recently taken under the supervision of the Department of Enlisted Specialists, Coast Artillery School, Fort Monroe, Va. The camera is actuated electrically, by means of the projectile in the case of direct-fire guns, and by the recoil of the top carriage in the case of mortars. Time exposure in both cases was about one five thousandth part of a second. These photographs are copyrighted and permissions to use the same for this article was obtained.

New York State Education Building

By J. A. Stewart

THE beautiful State Education Building, dedicated at Albany, N. Y., last month, is the only edifice of its kind in this country or abroad. It is of classical design, built in white marble, terra cotta, and dark granite. The façade consists of a Grecian marble colonnade resting upon a proper and powerful granite stylobate. This huge marble colonnade stands out well from a wall pierced by a series of large semi-circular openings which allow great window area and produce a secondary architectural effect. The colonnade supports a beautiful attic and cornice. The roof is of copper, the eaves being decorated by a carved *chenеau*. The rear walls are of light-colored vitreous brick and terra cotta. A fine flight of granite steps leads to the main entrance at the center of the building, which is placed about 50 feet back from the sidewalk to permit of landscape decoration.

The State Education Department occupies the first floor. The State library is located on the second floor. Various educational divisions, including the examinations, and educational extension divisions, and the library school find place on the third floor.

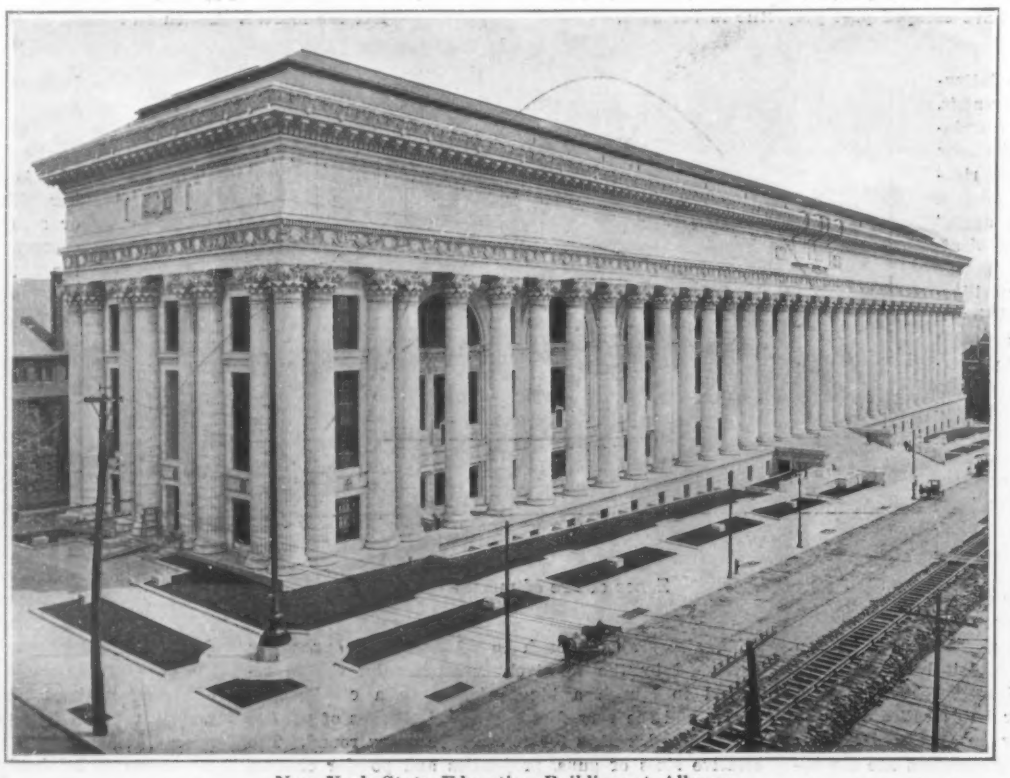
The State museum is allotted ample space on the fourth floor. Here in rooms lighted from above, are adequately housed the scientific collections of the State. The New York State Museum is one of the oldest public scientific museums in America, and it has the largest scientific collection belonging to any State in the Union. These collections, previously scattered through five buildings, are in many respects unequaled. Previous to the opening of the new museum scientific specimens of all kinds were stored away in many hundreds of boxes and cases, some of which had not been opened in half a century.

The principal room of the new museum is 570 feet long, 50 feet high and 54 feet wide. It is subdivided into sections, and is one of the most spacious museum rooms in the United States.

The library reading rooms are very large. There is an enormous stack room for 2,000,000 volumes. A novel feature of the library is the introduction of stack rooms in the center of the building, for easy access. The general reference room has stone walls and is lighted by eleven large leaded glass windows. Its dimensions are 106 by 130, the ceiling being 50 feet high.

The basement contains the big safety vault, 15 feet by 43 feet, for the keeping of valuable documents. Within this is a small vault of special construction which is used for the storage of the "Emancipation Proclamation," Washington's Farewell Address, the André papers, the King Charles II Charter, the Washington relics, etc. Large fans for forcing fresh air to all the offices are provided in the basement. There is also a complete vacuum cleaning system.

The entire cost of the building was three and one half million dollars, the site costing nearly half a million more. The space provided is 11,348,850 cubic feet, as compared with 14,475,000 cubic feet of space within the State Capitol building, and this great area is expected fully to meet the requirements of the numerous scientific and library features above mentioned.



New York State Education Building at Albany.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Domestic Dough Kneader

To the Editor of the SCIENTIFIC AMERICAN:

Seeing in your number for July 13th, page 41, Notes for Inventors, "Wanted, a Domestic Dough Kneader," you have it now. We all have it in domestic service, in the form of a meat chopper (cutting meat by revolving blades). If a stiff biscuit dough is run through this three or four times, it is well worked and makes the bread that you might obtain by use of the old-fashioned fluted roller or the more ancient method of beating the dough with a hatchet or hand ax for thirty minutes.

Charlottesville, Va. A SUBSCRIBER.

Railway Rails and High Speed

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 10th, under "Engineering," referring to the subject, "Reduce Railway Speed," in which the decision is "Too fast for safety," and the remedy suggested is "More metal in the rail base," your reply is that "both points of view are correct," and farther on, that "the sole requirement is a heavier and better rail."

Kindly permit me to disagree with all of the above and get down to the real and acknowledged cause of almost every broken rail. It is the piston, main-rod, side-rod, and counterbalance hammer-blow of the hundred-ton locomotive. I contend that any rail that will bear transportation and the necessary rough handling is competent to carry faster trains and heavier locomotives, *by simply taking the hammer-blow out of the locomotive.*

St. Louis, Mo. GEORGE J. FERGUSON.

Gasifying Coal at the Mine

To the Editor of the SCIENTIFIC AMERICAN:

In the September 21st, 1912, number of the SCIENTIFIC AMERICAN (cvii, No. 12), page 241, is an interview with Sir William Ramsay by Paul F. Mottelay, on "Gas-power Direct from the Coal Pit." It is mentioned therein that recently "Ramsay made the first public reference to his projected power scheme," which is based upon the possibility of burning coal in the depths of the earth to produce gas, which is then conveyed by pipe to engines in a power house on the surface. I beg to direct your attention to the fact that this is claimed in English patent 21,674, of September 22nd, 1909, issued to A. G. Betts, of Troy, N. Y. The process of Betts for utilizing unmined coal consists in gasifying the fuel as it lies in the seam in a similar manner to that in which it is gasified in a gas-producer; shafts are sunk, boreholes made, a fire started, and air and steam supplied. Betts describes a number of methods of working in his claims.

New York city. W. A. HAMOR.

The Bureau of Chemistry

To the Editor of the SCIENTIFIC AMERICAN:

I inclose some notices of judgment in pure-food law cases, apropos of some correspondence noted in your columns.

The fines are always so absurdly small that they have no deterrent effect whatever. The unreasonable delay in publishing these notices makes it impossible for the trade press to notice them. A case which was ended ten months ago is too ancient for notice. It certainly looks as though deliberate effort were being made to stifle the law in the courts and by the judges of the Federal bench.

This sounds absurd, but the notices I inclose are not unusual. They are just the ordinary run.

San Francisco, Cal. A. CROFTON.

[The notices referred to by our correspondent are the following:

Notice of judgment 1605, entitled "Adulteration and Misbranding of Lemon Flavor." "On February 13th, 1912," the notice ends almost apologetically, "the defendant entered a plea of guilty and was fined $100 and costs, this being a second offense."

Notice of judgment 1606, entitled "Adulteration and Misbranding of So-called Castor Oil." The last sentence of the notice reads: "On February 13th, 1912, the defendant corporation entered a plea of guilty, and the court imposed a fine of $10 and costs." Fines of this amount for manufacturing firms amount only to a small license.

Notice of judgment 1604, entitled "Adulteration of Oysters in Shell." No fine was imposed. The notice does not even mention the name of the shippers. The report was not issued until six months after final action.

Notice of judgment 1607, entitled "Adulteration of Tomato Pulp," states: "On March 1st, 1912, no claimant having appeared for the property, judgment of condemnation and forfeiture was entered, and it was further ordered that the products covered by all libels should be destroyed by the United States Marshal and that the barrels containing the same should be sold." In the opinion of our correspondent, "such judgments make a farce of the law. They say in effect: 'If you get caught, you lose that particular shipment. That's all.'"

Notice of judgment 1600, entitled "Adulteration and Misbranding of Highland Brand Tomato Catsup; Misbranding of Compound Glucose Apple Jelly; Adulteration of Waldorf Brand Tomato Catsup." The notice comments upon the filthy and decomposed condition of the shipment. "On March 19th, 1912, the defendant company appeared in court and entered a plea of *nolo contendere*, whereupon a fine of $1 was imposed in each of the three cases, with costs." Our correspondent naturally asks: "What end will be served by a $1 fine?"

Notice of judgment 1603, entitled: "Adulteration and Misbranding of Frutena." In this case the Acting Secretary of Agriculture decided: "On February 13th, 1912, decree of condemnation and forfeiture was entered, and it was further ordered, upon presentation of a bond in conformity with section 10 of the Act, and payment of costs, that the shipments be released and delivered to claimants." The name of claimants is not shown.

Notice of judgment 1602, entitled: "Misbranding of Salad Oil; Adulteration and Misbranding of Vanilla Flavor." The decision reads: "On January 5th, 1912, the defendants entered a plea of guilty, and they were sentenced to pay a fine of $25 on each of three counts, namely, misbranding of salad oil, adulteration of vanilla flavor, and misbranding of vanilla flavor, and costs taxed at $25.26." This, in the opinion of our correspondent, is another typical fine. "The length of time elapsing between the date of judgment and the issuance of the notice," he states, "is seldom less than seven months—sometimes a year. This kills publicity in the trade journals, which would record cases otherwise."

We publish the foregoing letter and the comments thereto (emanating from the writer of the letter) merely that all sides of the administration of the Pure Food and Drugs Act may be considered. The SCIENTIFIC AMERICAN is concerned chiefly with the scientific work required to administer the law effectively. It has no doubt but there are legal difficulties in the way, as well as scientific incompetence in the Bureau of Chemistry.—EDITOR.]

The Mississippi River Problem

To the Editor of the SCIENTIFIC AMERICAN:

The platforms of both the principal political parties declare for such measures as may be found necessary to prevent disastrous floods in the Mississippi River.

Any work in this direction by the general government must be preceded by legislation; legislation should be preceded by intelligent understanding of the situation; when the facts are generally comprehended, the merits of any proposed measure can be weighed and the best adopted.

It is a fact that the plane of flood height of the lower Mississippi is certainly increasing; the proof is found in the increased heights of levees now necessary over those of a short decade. For instance, the North Protection levee in Carrollton bend previous to 1890 was nine feet above the surrounding land; in 1893 the high water reached the top of the levee; since then it has been raised to eighteen feet; the recent high water of this year reached within five and one half feet of the top of this levee, notwithstanding numerous breaks in the levees above.

The causes of the steady increase in flood heights are: the clearing of forests and increasing areas of land in cultivation; the reclamation and ditching of vast areas of swamp lands; the cramping of the capacity of the river bed by the building of levees; the natural tendency of the river bed to slowly rise. These conditions may be expected to continue.

The underlying fact is, that more water is forced into the lower Mississippi, at times, than it is able to deliver to the Gulf.

Strictly speaking, the Mississippi River flows into an estuary of the Gulf of Mexico which extends inland to the mouth of Red River.

When the silt-laden waters of the Mississippi flow into this estuary, there begins a precipitation of the silt. Before the construction of the jetties this silt was finally deposited at the entrance of the estuary and formed bars that were an obstruction to navigation, the removal of which led to the building of the jetties, which are but a narrowing of the channel to induce a current to carry the silt out into the Gulf. It will be apparent from this that the reach of the Mississippi, below the mouth of Red River, needs and must have an active current to maintain the present depth of water through it and through the jetties. It follows then that any plan for the diversion of waters from the Mississippi should not interfere with the normal flow needed below the Red River.

By act of Congress approved June 25th, 1910, the Mississippi River Commission was directed to investigate as to the "necessity, urgency, and practicability of permanently separating the waters of the Red and the Atchafalaya rivers from those of the Mississippi River."

This is the first step in the direction of diverting water from flowing into the Mississippi, and will undoubtedly afford some relief to the section below the mouth of Red River, which is the real danger spot of the problem; at the same time it is in the line of preventing the Mississippi from making a new route to the Gulf *via* the Atchafalaya River.

The writer believes that it is practicable to relieve the entire valley, from Cairo down, from destructive floods by utilizing a natural drainage channel that parallels the Mississippi on the west.

At a point on the Mississippi about fifty miles above Cairo and immediately below Cape Girardeau, Mo., the head-water tributaries of the St. Francis River are but ten to fifteen miles distant, with no physical or topographical obstacles to the construction of a drainage canal to draw from the Mississippi a portion of its flood waters.

There is at hand an inexhaustible supply of stone to make the intake impregnable at a minimum cost.

The flow from this canal would be into one of the tributaries of the St. Francis, where it would end; its control would then be assured by the building of low levees placed far enough apart to provide the area needed without exceeding five feet in height; in fact, through the "Sunken Lands" district of Missouri and swamps of Arkansas the levees might be placed as far as ten miles or more apart, thus impounding considerable bodies of water to drain off slowly.

From the St. Francis a canal of twenty-five miles would connect with the White River. This canal need be no wider than the St. Francis, nor deeper, at the intake, than to add a percentage of its flood waters, the control of all being secured by the line of low levees. From the White River a canal of ten miles would connect with the Arkansas River at a point where a canal of about fifteen miles would connect with the headwaters of Bayou Bartholomew. Where Bayou Bartholomew empties into the Ouachita River the distance to connect with the Castor or Little River is about thirty miles, but by following down the Ouachita seventy-five miles, the distance is but ten miles. The Little River through its connections flows into Catahoula Lake, thence into Red River.

From Red River to the Gulf, choice could be made of various routes. Louisiana, between Red River and the Gulf, is a network of bayous and streams that lead to tide water. The construction of a special waterway to flow into either Grand Lake or Vermillion Bay would not be an expensive proposition.

The entire distance from the head of the first canal on the Mississippi to Red River is through low-lying lands subject to overflow from local streams, there being but a small percentage under cultivation.

The net result of the plan thus outlined would be the diversion of a portion, if not all, of the flood heights of the Mississippi above Cairo, the St. Francis, White and Arkansas rivers, without affecting their *régime* at ordinary stages. The natural conditions permit the placing of levees far enough apart to provide for the volume of water without building them to exceed five feet high.

An outlet from the Mississippi cannot be attempted anywhere below the mouth of the Ohio, through the light alluvial soil, without risk of inviting the entire river to change its channel.

The diversion suggested in this article begins at a point on the river above the mouth of the Ohio, where conditions of soil and proximity of stone make it safe to draw from the Mississippi all, or a portion, of its flood water; the streams flowing toward the Gulf supply the directing channel and slope of bottom; the short canals needed to connect and make continuous the system are inexpensive to build; it will cost less to build new levees five feet high than to raise the old ones two feet.

There is another possibility in the line of diversion; where the Tennessee River touches the northeast corner of the State of Mississippi, it is but about twenty miles to the watershed that empties into the Gulf through the Tombigbee River, its connections, and Mobile Bay.

An inexpensive survey would determine the practicability of diverting the flood waters of the Tennessee River, which would help reduce the flood height at Cairo and the entire valley below.

It is a serious question whether or not the levees on the lower Mississippi should be made higher. The high water of this year flowed over the tops of many of them two to three feet. From past experience it would seem that the limit of height has been now reached, with some levees twenty-three feet above the surrounding land.

An example of what dependence on high levees may lead to is found in the disaster on the Yellow River in China in 1852, when the floods broke the levees, made a new channel to the sea, with its mouth six hundred miles from the old one.

The time is here, right now, when a choice must be made between some system of diversion or higher levees. The Mississippi River problem must be solved correctly and quickly or the lower valley will retrograde in population and progress.

Chester, Miss. SAMUEL L. YOURTEE.

Aerodynamic Experiments of Duc de Guiche

By the Paris Correspondent of the Scientific American

THE possession of accurate scientific data as to wind pressure upon plane surfaces is of inestimable value to designers of aeroplanes or airships. Such data are, however, very difficult to obtain, and up to the present but few experimenters have ventured to undertake the work. On this account the researches which have been made in France by Duc de Guiche are of great interest, the more so as he employs surfaces mounted on an automobile so as to approach very nearly the conditions which occur in actual practice. Heretofore most experiments of the kind have been made in the laboratory. What he desires to obtain is not the total pressure on a given surface, but the pressures at different points, as it is well known that such pressures are quite different at the edges and the middle of the plate. The present experiments were carried out in the forests of Villefermoy, near Paris, on a specially prepared stretch of road, over which the automobile carrying the apparatus was run.

The road was treated with tar for a stretch of 300 feet so as to avoid deterioration and to keep dust out of the apparatus. Stretched across the road 10 meters (32.8 feet) apart were two rubber tubes, so that the wheels of the automobile could run over each tube in turn and give a record by compressing the air in the tubes. These latter were closed at one end, while the other end communicated with the recording device in a small cabin at the side of the road. Both tubes were joined to a Marey capsule or pressure indicator in which the air pressure causes a diaphragm to expand, and the needle on the diaphragm makes a mark on a sheet of smoked paper carried on a rotating cylinder. With the cylinder rotating at a given speed by clockwork, the distance between the two marks on the cylinder produced by the passage of the wheels over the two tubes thus shows the speed of the automobile. A tuning fork is mounted so as to record its vibration continuously on the cylinder in the form of small waves, so that by counting the number of waves lying between the two notches produced by the diaphragm needle we have the speed very closely, knowing the number of vibrations per second of the tuning fork and the distance between the rubber tubes. The rear wheels of the automobile also make records in the same way as well as the front wheels, and these can be used as a check on the first set. In the experiments the automobile was started at 300 to 2,000 feet back of the tubes so as to reach a constant speed at the point where the record was made. The plane surface to be tested had to be accurately flat, otherwise there would be errors in the experiment. The surfaces were made true to within 0.002 inch. The plates were made of wood braced with metal or in other cases of aluminium. The wood plates had a length of spread of 4 feet 5 inches and a width of 2 to 3 feet from front to rear, with a thickness of 0.6 inch. The aluminium plate was 2 feet 8 inches square and 0.32 inch thick in one case. Other sizes of plates were also used. In all cases they were mounted over the front part of the automobile upon light and strong supports of angle iron and the plates could be adjusted at any angle by swinging on pivots, the angle being measured by a graduated sector at one side.

When the automobile is running on the road, it might be feared that its movement would cause disturbances in the air which would be felt upon the plane surface and thus cause errors in the experiments. To this end the automobile was made as flat as possible and all precautions were taken to have it give but little disturbance. The test plate was mounted at a height of 4 feet 4 inches above the plane surface which covered the hood, and this latter was 4 feet 6 inches from the ground. A light silk ribbon streamer was mounted in the space between the test plate and

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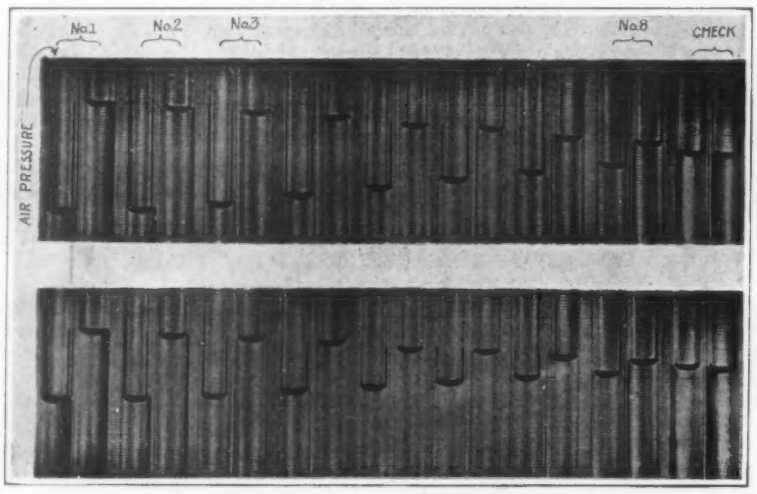
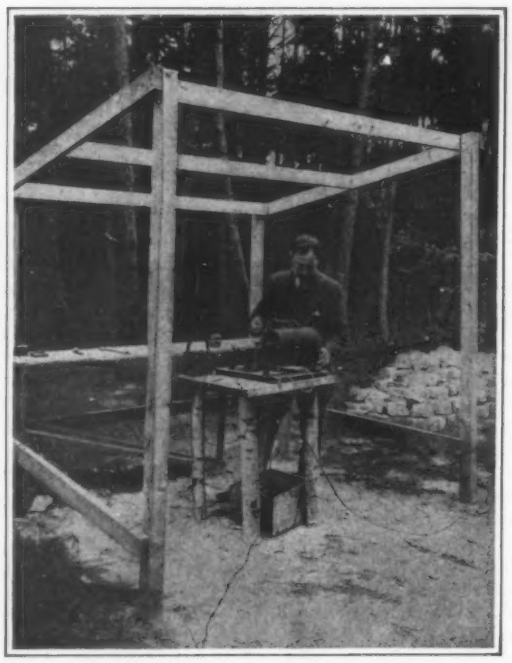


Two photographs of the pressure gages.



Determining the speed of the car.

Launching of the Battleship "New York"

First Ship of U. S. Navy to Mount the 14-inch Gun

THERE was launched on October 30th at the New York Navy Yard, the "New York," a battleship which marks a decided step forward in the development of the fighting power of our Navy. The ship takes over the name formerly held by the first of our armored cruisers, the famous "New York," which served as the flagship of Admiral Sampson during the Spanish War.

Those who were present at the recent review in the Hudson River were much impressed with the "Wyoming" and the "Arkansas," the latest and largest ships of our Navy present on that occasion. These vessels are 562 feet in length over all, of 26,000 tons normal displacement, and they carry a main battery of twelve 12-inch, 50-caliber guns. The "New York" and her sister ship, the "Texas," which was built at Newport News, are 573 feet in length over all and of 27,000 tons displacement, and their battery consists of ten 45-caliber 14-inch guns, carried in five two-gun turrets.

The "New York" is the third battleship of our new navy to be constructed at the New York Yard in Brooklyn. The first of these was the "Connecticut," now flagship of the Atlantic Fleet; the second was the "Florida," now in active commission in that fleet, and the "New York," which left the building ways on the morning of October 30th, is the third and by far the largest of the three, the respective displacements being, "Connecticut," 16,000 tons; "Florida," 21,825 tons; and "New York," 27,000 tons.

The keel of the New York was laid September 11th, 1911, and in the period of practically 14 months which has elapsed since that date, over ten thousand tons of material have been built into the ship, this being her launching weight. This fine ship has been constructed under the immediate supervision of Naval Constructor John E. Bailey, to whose energetic supervision and the zeal and hearty co-operation of the excellent working force of the yard, are to be attributed the early completion of this ship and the high character of the work which has gone into her. The ships built at the New York Navy Yard are proverbial for the thorough character of their construction, as witness the excellent record of the "Connecticut" and the "Florida." Although no one is prepared to deny that Navy Yard ships cost more than those built by private contractors, it is a question whether the high character of the work done and the reliability of the ships in service, to say nothing of the permanent retention at the yard of a highly skilled force of mechanics, do not fully compensate the nation for the extra outlay.

The recent ships built for the first line of defense of our Navy have the great advantage that in their main characteristics they greatly resemble each other. Each vessel is an enlargement and an improvement of the one that preceded it; there is no such bewildering diversity of design as characterizes—or until recently did characterize—some of the foreign navies. Thus the "New York" is an enlarged "Wyoming;" the "Wyoming" an enlarged "Florida;" the "Florida" a growth in natural and proper sequence from the "North

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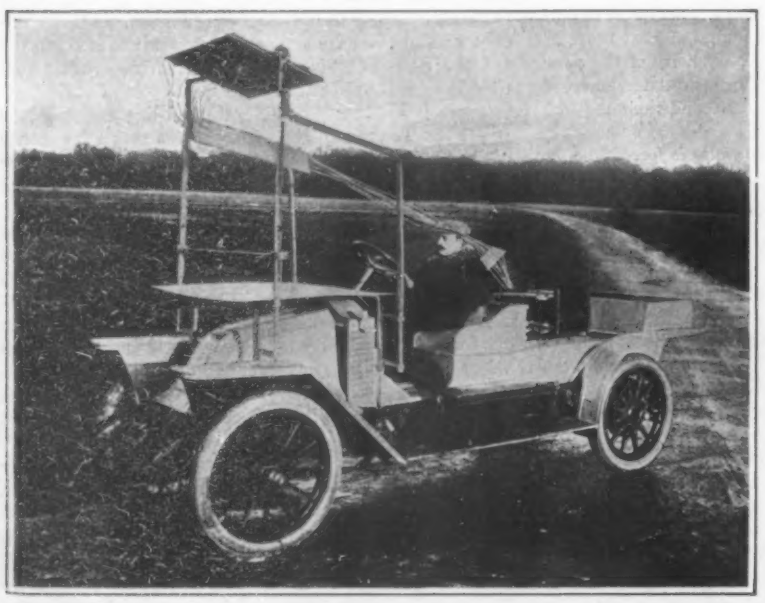
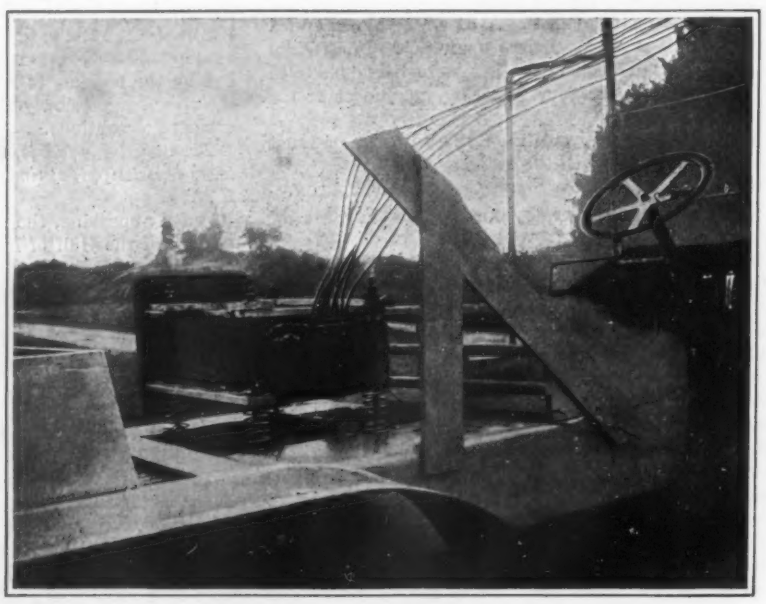
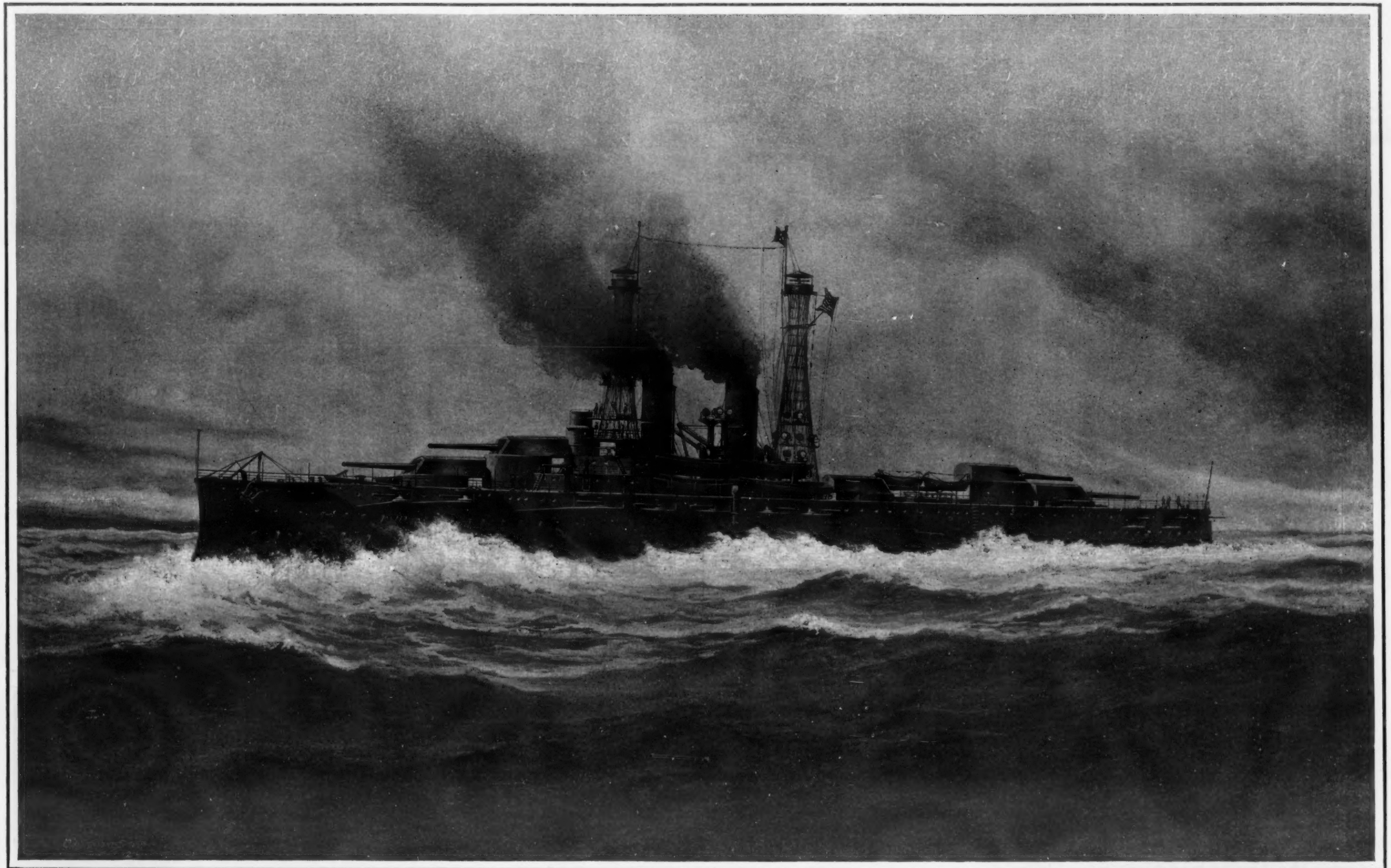


How the plane is carried above the car.



Mounting of the gage box and camera.

MEASURING AIR PRESSURES ON PLANES



Length, 573 feet. **Beam,** 95 feet 2½ inches. **Mean Draft,** 28 feet 6 inches. **Displacement,** 27,000 tons. **Speed,** 21 knots. **Coal,** 2,850 tons. **Oil,** 380 tons. **Armor:** Belt, 12 inches; gun positions, 12 inches. **Armament:** Ten 14-inch and twenty-one 5-inch guns. **Torpedoes,** four 21-inch. **Complement,** 1,070 officers and men. Launched at New York, October 30th, 1912.

"NEW YORK"—OUR FIRST BATTLESHIP TO CARRY 14-INCH GUNS

The Bushmen of Africa

Their Paintings and Etchings

By W. E. Gardner

(Photographs supplied by Dr. Elmore)

TO the greater portion of the civilized world, South Africa is a land of mystery; a sealed book. But to those born in it, and to others who have gone to it to make it their home, it is a land of fascinating interest. It is at once one of the oldest and one of the most wonderful countries of the globe. Of comparatively recent years it has been known chiefly for its vast quantities of gold and diamonds, but its main interest attaches not to these two great sources of wealth. Throughout its mighty length and breadth, Africa conceals historical secrets the antiquity of which reaches back to times when the human race was in the very cradle of its evolution.

To explorers of the Dark Continent, one of the most interesting phenomena has been the commonness of what are known as Bushmen paintings. They are found throughout the sub-continent. In the various caves and natural shelters occupied in their wanderings by nomadic Bushmen are to be seen to this day, in a wonderful state of preservation, their crude paintings on the faces of the rocks.

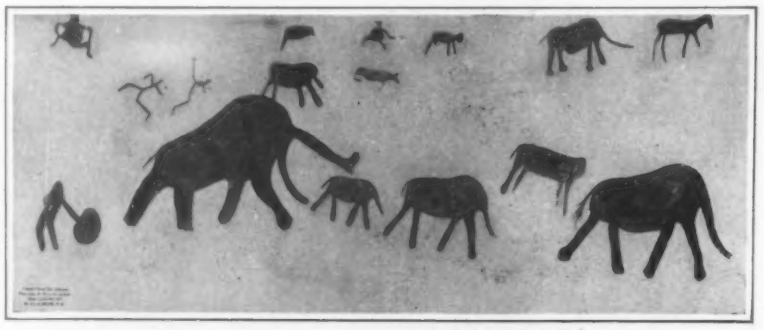
Investigation traces the Bushmen back to the Paleolithic Stone Age, and their direct descendants are to-day met with principally in the dense-forest dwellers of Central Africa, though also in isolated instances in the Cape Colony. They have, through non-intermarriage, preserved the purity of their race—but at the cost of remaining one of the most retrograde among the native tribes. They continue to dwell in the caves and rock fissures in the same primitive state as their ancestors of thousands of years ago; and even their chief weapons still are the little bows and arrows (the latter made infallibly deadly with the venom of snakes) such as their progenitors of remote ages used.

The Bushmen were undoubtedly the aboriginal inhabitants of this country. After Dr. Phillip started a mission at Loverberg, in 1814, these people, who had been living by plunder, soon learned to be self-supporting, and when it was abandoned (by command of the Governor at that time) they degenerated again into barbarism. This fact proves that had the Bushmen been properly treated there would have been no reprisals on their part, for during the three years of the mission no depredations at all were committed by them. When, however, their game was driven away and their fountains were confiscated by the Boers, there was nothing left for them but to steal the flocks and herds to enable them to exist.

As stated, game constituted their main food supply, which circumstance accounts in all probability for practically the whole of their paintings depicting incidents of the chase. It should, however, be mentioned that some of the subjects are supposed to represent religious ideas. Indeed, there can be no doubt that a considerable number of the paintings illustrate Bushmen mythology; and this being so, they must be regarded as something vastly more expressive than mere daubs executed for amusement's sake alone. To their authors they conveyed a distinct and definite purpose.

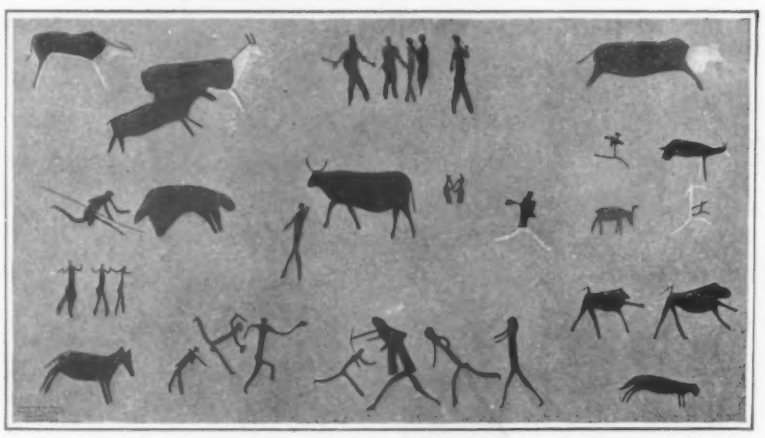
It will no doubt interest Americans to learn that one of their countrymen, Dr. J. L. Elmore, of Kansas City, Missouri, for some considerable time has been making a close study of Bushmen paintings, and when his investigations are concluded he will not only rank prominent among the foremost authorities on the subject, but he will also be the possessor of one of the most complete and most accurate, if not the finest, collection extant of these curious works of art. The next best collection will be that in the custody of the Port Elizabeth Museum, South Africa, Dr. Elmore having, at the cost of infinite labor and time, reproduced in true detail and color an entire set of his own tracings which he generously donated to that institution. One of them is fourteen feet in length. Dr. Elmore's collection will, however, excel that of the museum inasmuch as he, being the possessor of over two hundred different and separate drawings, can copy any number and effect exchanges with other collectors.

Bushman painting of the chase. From the original of Post Elizabeth.

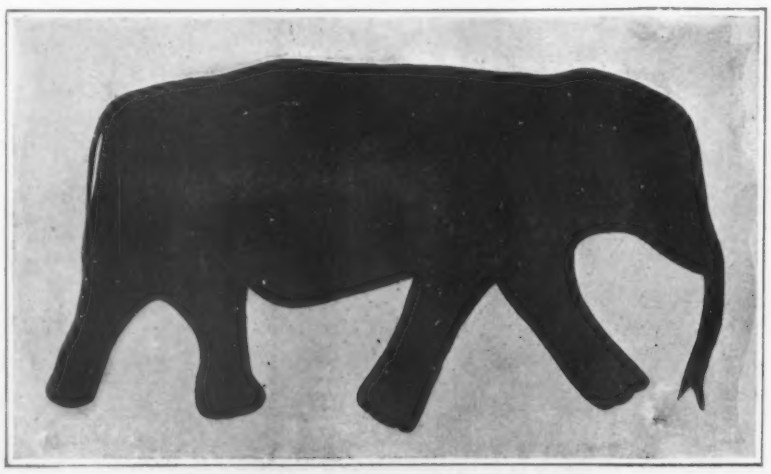


Hunters rounding up a herd of elephants.

A fine group done in several colors, found at Post Catherine.



A miscellaneous lot of human and animal specimens.



A Bushman's painting of an elephant.

For twenty years Dr. Elmore's tours have taken him beyond the Victoria Falls; he has tarried among the Matoppos—the resting place of Cecil Rhodes; Rhodesia, Matabeleland, Mashonaland, and in the West, Zululand and the Garden colony of Natal; while there is hardly a square mile of the Cape, Orange Free State and the Transvaal that he has not traveled. His inquiries into natural history have been extremely varied. He has succeeded in getting two thousand specimens of butterflies, which he presented to an American museum. The ophidia have also claimed his interest, and he prepared gratuitously for the Durban Museum the skeleton of a Natal rock python, the task occupying him eighteen months. During the last two years he has given his study to Bushmen paintings and Kaffir folk-lore in all parts of the country, as well as to native manners and customs. In these last investigations he has enjoyed exceptional facilities by reason of the fact that he has had access to all the literature concerning the aboriginal and native tribes since 1870.

In Bushmen paintings it has been stated that the subjects chosen by the primitive artists were mainly game; and the now fast-dying eland, one of the largest and most beautiful of the African antelopes, was the animal specially favored by them. By the courtesy of Dr. Elmore I am enabled to supply the SCIENTIFIC AMERICAN with photographs of the paintings for reproduction, but they lose considerably by having to be printed in the ordinary black and white instead of in the quaint tints found in the originals. The colors in which the paintings have so far been discovered are red, yellow, blue, brown, black and white, and Dr. Elmore is convinced that they are the natural oxides. At Post Catherine, beneath some paintings, he found a natural pocket of color. It was the pigment of the rock; a beautiful yellow than which a superior cannot even now be made. On taking a little on the finger-nail and comparing it with a picture, the doctor found the tint to be exactly similar. At another place some other oxide that had weathered off the rock was seen and proved on examination to be as fine a powder as the most perfect grinding machinery of the present time could produce.

In the course of his investigations the doctor concluded that when the Bushmen wished to represent two animals standing so closely together as to "overlap," they adopted the slow method of first depicting one animal and leaving it to dry and then painting the other upon it. The reason for this undoubtedly was that the pigmies possessed no sense of perspective. On one or two occasions Dr. Elmore came across shaded drawings.

Where the double pictures are seen it would indicate that the little savages were sufficiently long in occupation of the particular caves to have been able to devote some appreciable time to their work; while in those instances in which the panels are

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The Heavens in November

The Defining Power of Small Telescopes

By Henry Norris Russell, Ph.D.

GALE'S comet, of whose discovery we spoke last month, is still visible in the evening sky, but only with the telescope. At the beginning of November it is in 16 hours 3 minutes right ascension and 25 degrees north declination, and is moving a little less than 1 degree northerly and 1 minute easterly per diem. Its orbit is nearly, if not quite, parabolic in form, and is remarkable chiefly for the fact that its plane is almost at right angles to that of the ecliptic. Its closest approach to the Sun occurred on October 5th, at a distance of 67,000,000 miles. Though now growing fainter, it will probably be telescopically visible for some time to come.

The second comet to be discovered in 1912 was detected by Schaumasse at Nice on October 18th. It was then in the constellation Sextans in 9 hours 58 minutes R. A. and 1 degree 36 minutes north declination—about 10 degrees south of the bright star Regulus in Leo—and was moving eastward. Until further observations have been obtained, and its orbit computed, it is impossible to say whether it will become conspicuous, or remain faint, as at present; but the chances are in favor of the latter event.

A recent inquiry from a correspondent suggests the discussion of the question of the defining power of small telescopes, such as are in the hands of many amateurs—especially of those from two to five inches in aperture.

Even the smallest of such instruments will reveal enough to afford the star-gazer many evenings of the keenest interest; but there are, of course, limits to the power of any given telescope, both theoretical and practical, and of some of these we may well speak.

The principal functions of a telescope are its light-gathering and magnifying powers. The former depends primarily on the clear diameter—or "aperture"—of the object-glass; the latter, on the relation between the focal lengths of the object-glass and eye-piece.

The pupil of the human eye, when widely expanded, as it becomes in a faint light, is about one fifth of an inch in diameter. A telescope two inches in aperture collects all the light falling on a circle of ten times the radius, or one hundred times the area; and hence, if all the light falling on the object-glass was concentrated, without loss, into the observer's eye, such an instrument should show stars one hundred times as faint as the faintest visible to the eye without its aid. In actual practice, the losses of light by reflection at the surfaces of the lenses, and by absorption in passing through them, diminish the light-gathering power to about two thirds of this ideal value, so that a two-inch telescope will actually show stars about 65 times fainter than those just visible to the naked eye. For a four-inch glass the limit of brightness would be four times fainter; for a six-inch, nine times; and so on, in proportion to the square of the linear aperture.

These facts may be stated in another way, by giving a little table of the stellar magnitude—in the ordinary astronomical reckoning—of the faintest stars visible to a normal eye with a *good* telescope of given aperture, *under favorable conditions.*

Aperture	1 in.	1½ in.	2 in.	2½ in.	3 in.	4 in.	5 in.
Magnitude	9.0	9.9	10.5	11.0	11.4	12.0	12.5

It should, however, be clearly understood that this table shows only what a telescope may be expected to do on a fine clear night, with dark sky (not in moonlight) and with steady air; and that it applies to isolated stars, and by no means to the faint companions of bright ones or the faint satellites of the bright planets.

For example, the third satellite of Jupiter, if isolated, would be easily visible to the naked eye; and two fairly bright stars, at the same apparent distance in the heavens as Jupiter and this satellite (when best placed) could be easily separated without instrumental aid. But Jupiter is so bright that its satellites are actually hopelessly beyond the reach of unaided vision, except perhaps for a few very unusual persons.

With respect to magnifying power, the observer has a little more freedom, for by a simple change of eye-pieces he can pass from one power to another. But here again there are limits. With a power less than five for each inch of aperture (e. g., less than 15 for a three-inch telescope) the light which enters the object-glass is not all concentrated into the observer's eye, and the power of seeing faint stars is decreased. With a power exceeding about 60 for each inch of aperture, the images become hazy, and no advantage is gained by further magnification.

The reason for this is found, not in any imperfections of the instrument, but in the nature of light itself. It can be shown (by methods far from elementary, but mathematically trustworthy) that, if an image of a star is formed by a lens of a given diameter, this image will not be a perfectly sharp dot, but a small disk of light, fading out gradually toward the edge, and surrounded by rings of light, only a few of which are usually bright enough to be seen. In the same fashion, the image of a narrow line of light has the form of a linear band, of small but definite width, with faint attendant bands on each side. These "spurious disks," rings, or bands of light are merely optical phenomena, and have no counterpart in the nature of the object under observation, but they cannot possibly be avoided. When the aperture through which the light passes is narrowed, this "diffraction pattern" grows larger, doubling in size if the aperture is halved. When the opening is very narrow, they may even be seen by the naked eye. For example, if one looks at a linear source of light (such as a flat gas flame seen edgewise) through a narrow gap between two lead-pencils held just in front of the eye parallel to the line of the flame, it is easy to observe that, when the slit through which one is looking is made very narrow, the line of light seems to widen out, and to be accompanied by fainter bands on each side. A still more instructive experiment may be made by looking, through the same improvised slit, at a pair of fine parallel lines close together—such as two wires or strings against the sky. As the slit (which again must be kept parallel to the strings) is narrowed, the dark lines become ill-defined, and they can no longer be seen double.

This latter experiment illustrates perfectly why it is impossible to separate the components of a very close double star with a small telescope. What the eye sees directly in the one case is just what it would observe, with the aid of suitable magnifying power, in looking at a double star through a telescope whose clear aperture could be diminished by an iris diaphragm. When the opening diminishes to a certain size, the star can no longer be seen double.

This theoretical limit of separation of the closest pair of stars that can be resolved by a telescope of given aperture can be found by dividing 4 minutes 5 seconds by the aperture in inches, the results being:

Aperture	1 in.	1½ in.	2 in.	2½ in.	3 in.	4 in.	5 in.
Limit of Separation..	4.5 in.	3.0 in.	2.3 in.	1.8 in.	1.5 in.	1.1 in.	0.9 in.

It must once again be emphasized that this applies only to the *most favorable conditions.* The stars of the pair must be of sufficient and nearly equal brightness; the air must be clear and steady; and the observer's eye must be trained; for in such a case the two stars seem so close together that the novice might easily take them for one.

When (as unfortunately is almost always the case) the air is unsteady, the star-images dance about and change shape, and it is only in more or less fleeting moments that they are well enough seen to reveal the two tiny disks of light.

A pair of stars of very unequal brightness must be much farther apart to be observable. As an extreme instance we may take Sirius. This has a companion of magnitude 8.5—which, if isolated, would be conspicuous in a two-inch instrument. When nearest to Sirius (about 1893) it was (according to the computed orbit) fully 2 seconds from it. A pair of stars of equal brightness, at the same distance, could easily have been separated with a three-inch aperture. But, owing to the glare of Sirius, which is ten thousand times as bright as the companion, the latter could not be seen, even with the great Lick refractor, when nearer than 3½ seconds to its primary.

It should finally be remembered that the objects mentioned in treatises on astronomy as "good tests" for a telescope of a given aperture are purposely chosen so that only an instrument of first-class workmanship (and of the given dimensions) will reveal them to a practised eye, under the best observing conditions. Hence the amateur need blame neither his telescope nor himself if he fails to observe them satisfactorily until after acquiring experience on easier objects, and then after many trials.

At 11 o'clock: Nov. 7.
At 10½ o'clock: Nov 14.
At 10 o'clock: Nov. 22.

At 9 o'clock: Dec. 7.
At 8½ o'clock: Dec. 15.
At 8 o'clock; Dec. 23.

At 9½ o'clock: November 30.

NIGHT SKY: NOVEMBER AND DECEMBER

The Heavens.

As our map shows, the five winter constellations have now returned to the evening sky. Orion is in the southeast, with Sirius blazing below, and Aldebaran and the Pleiades above. Auriga is high in the northeast, the Twins—Castor and Pollux—are below, and Procyon still lower down, due east.

In the duller region of the southern sky we find the extensive constellations Eridanus and Cetus, which are perhaps most noteworthy as containing two of the very nearest stars visible to the naked eye. These are τ Ceti and ϵ Eridani, both of which are shown on our map. That the former was a near neighbor of ours has been known for some years, but recent measures show that the latter has also a parallax exceeding 3 seconds and a distance of about ten light years. δ Eridani is also near us, though almost twice as far away.

Perseus, Andromeda, and Aries are almost directly overhead. Pegasus, Aquarius, and the Southern Fish are in the west and southwest, and Cygnus and Lyra in the northwest.

Ursa Major is low on the northern horizon, Draco and Ursa Minor but little higher, and Cepheus and Cassiopeia well up in the north.

The Planets.

Mercury is evening star all through November. The best chance of seeing him comes about the 7th, when he is farthest from the Sun in appearance (though almost at the nearest point of his orbit to that luminary). He is, however, very far south, in Scorpio, and sets about 5:45 P. M., so that he will be hard to see.

Venus too is evening star, about 15 degrees west of Mercury, and sets about an hour later; but, unlike Mercury, she becomes increasingly conspicuous all through the month. On the 7th she is in conjunction with Jupiter, being 1 degree 43 minutes south of him. The two brilliant planets will be a fine spectacle in the twilight.

Mars is in conjunction with the Sun on the 4th, and is invisible.

Jupiter is evening star, as already described.

Saturn is in Taurus, between Aldebaran and the

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Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Modern Methods of Handling Heavy and Bulky Merchandise

IN these days of "scientific management," when the cost of everything has to be carefully considered, it is desirable to use every cubic foot of space in a warehouse and to do the work of stacking and removing cases, etc., with as few men as possible. When land was cheaper, not much thought was given to the area wasted in warehouses; goods often lay around on the floors and the space near the ceilings was neglected. If conditions required the goods to be tiered, many men were required to do the work by the "main strength method." Nowadays, however, any device which will reduce the cost of handling material is as welcome as any improved manufacturing device. Such a modern labor-saving device is a portable tiering machine, an improved type of which is shown by the accompanying illustrations and is known as a revolvator.

The revolvator is a portable tiering machine which can be wheeled to any place in a storeroom or warehouse and used for stacking barrels, boxes, bales, etc. It consists of two uprights and an elevating platform. The box or bale is placed on the platform of the revolvator when down, as shown in Fig. 1, and by means of a crank and gears the platform is then raised to any level desired. The device is then swung around on its own center, like a turntable, the wheels remaining fixed on the floor, and the load shoved off into place as shown in Fig. 2. Frequently the revolvator is swung around through 180 degrees, and the cases removed from the rear. This scheme makes it possible to stack a warehouse entirely solid and to eliminate all aisles.

Rollers are provided on the platform, so that as soon as the box reaches the desired level one man can easily slide it from the revolvator directly into the space where it is to rest. The revolvator is provided with double gears, one for high speed and one for low. Bales, cases, etc., up to 800 pounds can be easily handled by the high gear, and bales weighing from 800 to 1,500 pounds or more by the low gear.

In lowering boxes, bales, etc., the operations are reversed, that is, the platform is raised to a point slightly below the level of the box to be removed. The box is then slid onto the platform and allowed to descend slowly until it reaches the floor. The descending load is at all times under the control of the operator, as the machine is provided with a band brake.

There is no danger of the machine accidentally slewing around while in operation, as the upright is provided with a ratchet which locks it to the base in different positions. Neither is there any danger of the machine moving on its wheels, for when wheeled to position, the front wheel is turned at right angles to the two rear ones, and as soon as the handle is dropped it locks the front wheels, making it impossible for the revolvator to roll.

In order that the apparatus may be moved from room to room through low doors or placed on elevators and carried from floor to floor, the uprights are jointed, allowing the top half to fold over.

The revolvator is used for handling cases, bales, barrels, rolls and reams of paper, crated machinery, bath tubs, etc., in warehouses, and is also employed for loading railroad cars, trucks, etc.

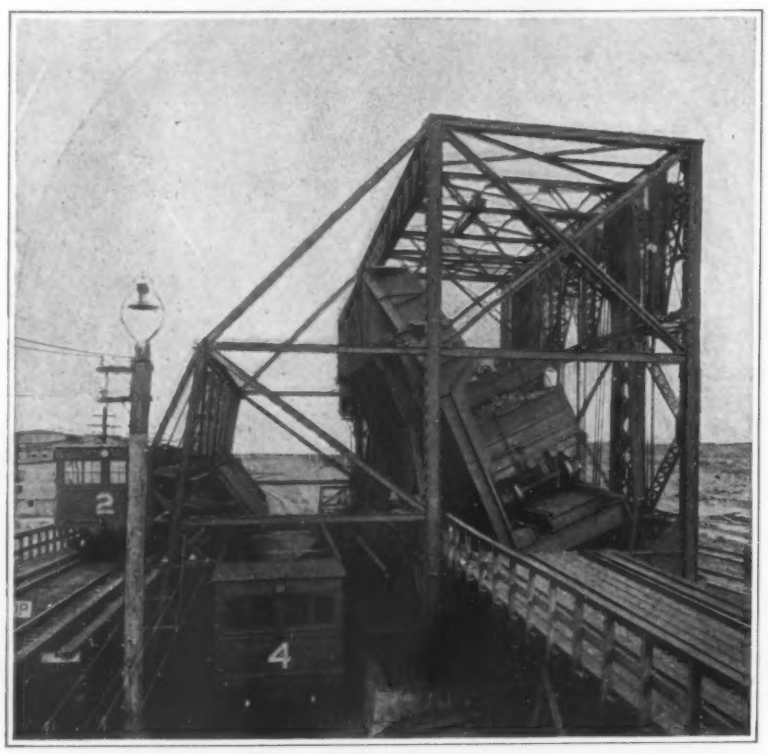
Fig. 1.—The box placed on the revolvator when the platform is down, is raised by a crank and gears.

Fig. 2.—The box when elevated to the desired level is easily rolled off into its proper place.

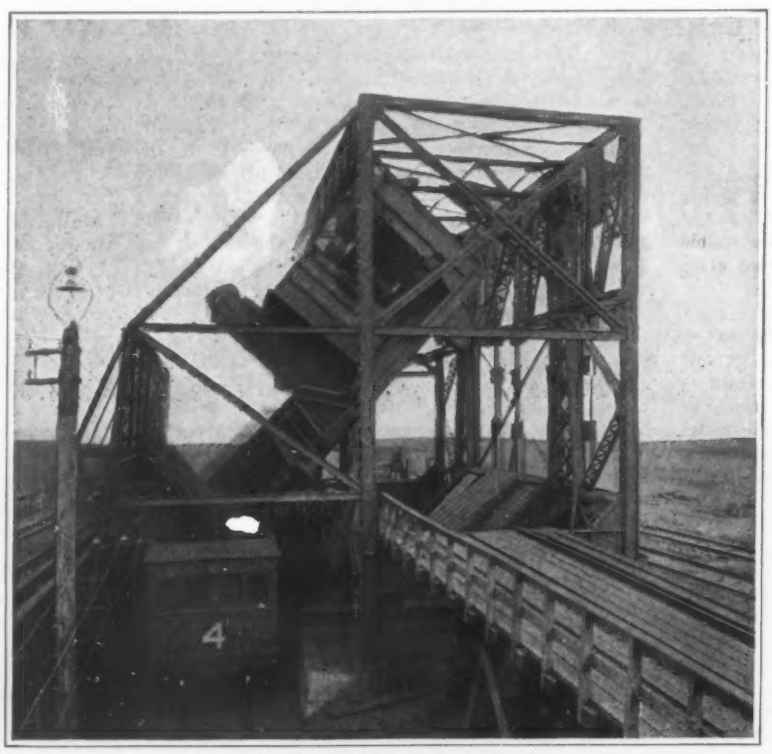
Dumping Fifty-four Tons of Coal in Two Minutes

THE economical handling of coal on its way from the mines to the consumer is a problem affecting the retail price of coal. The more efficiently the coal can be handled in the various transshipments, the better. Water transportation is the cheapest, and coal unloading machinery has been devised at various American coal ports for rapidly and cheaply transporting the coal coming from the mines (in 80 and 100 car trains) into the holds of waiting vessels. The annexed illustrations show a car dumper in use at Norfolk, Va., in action. This car dumper is an integral part of an elaborate coal unloading plant constituting the tidewater terminal of one of the coal-carrying railroads from the West Virginia mines. Its operation is the most interesting feature of this plant, as it empties railroad coal cars holding 50 to 54 tons of coal each as easily as the driver of a coal cart tips his load on to the sidewalk. The car dumper consists of a steel structure supporting a movable, elevated cradle. The loaded railroad cars are pulled up an incline one at a time by an electric motor-driven cable hoist. The moment the car reaches the cradle the car dumper operator starts a motor which first clamps the car securely down on to the cradle and then tips the cradle up and over through an angle of 100 degrees, so as to pour out the contents of the car onto a deflecting apron and into a receiving car waiting on a track level below. The receiving car (which is electrically operated) then conveys the load of coal up on to the pier from which it is discharged into the vessels.

The illustrations show the car dumper in two stages of its movement, and the hazy appearance above the apron in the second view is caused by the cloud of dust that arose from the 54-ton mass of coal poured out of the railroad car an instant before the photograph was taken.



The car beginning to turn.



The car in dumping position.

Miniature Baseball Game

A NEW amusement device has just been brought out which is played on a miniature diamond on a table similar to an ordinary billiard table. Miniature figures of players are used and they are disposed in the positions ordinarily occupied by baseball players on a regular diamond. The players are placed over a series of pockets. The face and sides of these pockets are cushioned and are so designed that the ball enters quickly and quietly. On either side of the table and in the rear there are pockets indicating singles, triples, home runs and fouls. The batter's box is near the front of the table, where an average size billiard ball is placed and then caromed off on a triangular rubber homeplate which is mounted on a pivot. This plate revolves when hit by the ball, giving the player a constantly changing shot which makes the game very scientific.

A Submarine Lifesaver

THE shock and horror of the loss of the "Vendemiaire" is of course still keenly felt in France, and it is much to be hoped that the new life-saving device for submarine crews will turn out to be all its inventor claims. M. Laplanche, of Toulon, who has just patented the apparatus, is an old sailor. His invention, as described in the marine journal, *Navigazette*, consists of a waistcoat and a helmet. The former, which permits entire freedom of movement to the wearer, is double and can be inflated with air or gas under pressure. It should be donned in every descent, and is intended to insure the rising of the wearer to the surface of the water.

The helmet is assumed only in case of danger and is meant to make respiration possible. It is capable of very rapid adjustment to the waistcoat.

The inventor is about to make three tests. The first, which will take place in a pool, is to show how long a man thus fur-

nished can live in the water. The second, to take place in a port, will be conducted as nearly as possible under the same conditions as in a real submarine which has met with accident. It is expected to prove that the wearer of the apparatus will come to the surface with certainty. The third will also take place in a port, making use of a salvage chamber, constructed by Laplanche to complete his invention.

Compulsory Licenses

By T. Hart Anderson

UNDER the provisions of the Oldfield bill, it is proposed to amend the patent laws so as to provide for the granting of compulsory licenses in those cases where a patent is more than four years old, and the patentee or those claiming under him fail to manufacture in the United States to an adequate extent, and provided the court is satisfied that the reasonable requirements of the public have not been satisfied by reason of the neglect or the refusal of the patentee to make, use or vend the invention, or to grant licenses to others on reasonable terms, it shall order the owner of the patent to grant a license to one applying therefor on terms to be fixed by the court.

This brings up the question as to whether courts of equity have not heretofore had and do not now have the right to compel the granting of such licenses, and whether they have not in fact assumed such right whenever the character of the evidence has warranted it.

Injunctive relief alone prevents the continued infringement of a patent, that is to say, the manufacture, use or sale of the patented invention by a stranger to the patent and without the consent of the owner of the patent. We all know that the refusal of a license does not prevent the appropriation of a patented invention by one who desires to use it. One who so appropriates a patented invention, however, places himself in the position of an infringer and is liable to the patentee for damages.

If the owner of a patent sues for damages alone, and a verdict is rendered in his favor, the infringer pays the amount awarded, and if he still desires to use the invention he may go on as before, leaving the patentee to his right of again suing him at any time within the running of the statute of limitations. The damages recovered constitute in effect a license fee which the infringer pays, and we may assume he is willing to pay for the license which he has appropriated. This is practically a compulsory license while it lasts, and sometimes, owing to the crowded condition of our courts, it may last for a period of years.

The owner of a patent, however, as a rule not only desires to secure damages, but also an injunction preventing and restraining the infringing acts in the future, and therefore patent suits are generally brought on the equity side of the court, and if the court finds the patent to be good and valid and that the defendant has infringed, it will issue an injunction restraining in the future the infringing acts of which the owner of the patent complains. As before stated, it is this injunctive relief which, when granted by a court of equity, puts a stop to the compulsory license arising from the unauthorized appropriation by an infringer of a patented invention.

The right to grant injunctions in patent suits is conferred upon the Federal Courts by statute, section 4,921 R. S. providing that such injunctions may be issued "according to the course and principles of courts of equity, to prevent the violation of any right secured by patent, on such terms as the court may deem reasonable."

The first legislation referring to injunctive relief in patent cases is the Act of 1819, which provided that the circuit courts of the United States "shall have authority to grant injunctions, according to the course and principles of courts of equity, to prevent the violation of the rights of any authors or inventors secured to them by any laws of the United States, on such terms and conditions as said courts may deem fit and reasonable." This provision of the Act of 1819 was substantially embodied in the Act of 1836, wherein section 17 provided for the granting of injunctions "on such terms and conditions as said courts may deem reasonable." The Act of 1870, section 55, contains practically the same provision "and the court shall have power upon bill in equity filed by any party aggrieved, to grant injunctions according to the course and principles of courts in equity, to prevent the violation of any right secured by a patent, on such terms as the court may deem reasonable." Then came the Revised Statutes, section 4,921 hereinbefore referred to, which is now the law, and which was amended by the Act of 1897 to fix a period beyond which damages could not be recovered.

It is therefore to be seen that courts of equity may fix *reasonable* terms upon which they will grant an injunction. It follows therefore that they may also refuse an injunction on reasonable terms. Whenever an injunction is refused, therefore, in those cases where the patent is good and valid, and infringement is proven, a *compulsory license* results, and in effect the court issues an order for a compulsory license in such form and upon such terms as it deems just. Strictly speaking, the court does not issue a license, but in refusing to disturb the infringer and to restrain his infringing acts, it to all intents and purposes grants a compulsory license.

Acting under the power thus conferred, courts of equity have time and again refused injunctions where the patent was valid and infringed.

In the case of Bullard v. the City of Pittsburgh, 12 F. R., p. 783, it was found that the city had infringed the patents sued upon, in that it had laid a wooden pavement constructed in accordance with the patents, but the court declined to issue an injunction on the ground that "any interference with the use of the wooden pavements constructed in the city of Pittsburgh, in infringement of the complainants' rights, would only operate injuriously upon the public without benefiting the complainants, and injunction will not be granted." The court however decreed an accounting to ascertain the profits and damages which should be awarded the complainants, which was in effect the amount of the license fee to be paid for this compulsory license so awarded by the court. The court in this case undoubtedly found that the "reasonable requirements of the public" justified it in *refusing* an injunction on reasonable terms.

It is true that the courts hesitate to refuse injunctions where the right to relief is clear, but the foregoing case shows that under some conditions they will do so.

In the case of Campbell Printing Press and Manufacturing Company v. Manhattan Railway Company, 49 F. R., 931, the court while refusing to act on the defendant's suggestion that because it was willing to pay for the use of the infringing devices it should be permitted to continue to use them on the ground that it would seriously interfere with the running of its cars if it were compelled to take off the infringing devices, yet the injunction was granted on terms which no doubt the court deemed reasonable, and the defendant was given a certain length of time to remove the alleged infringing devices. During the running of that time, the defendant had in effect a compulsory license.

Many times have the courts refused to grant preliminary injunctions on the ground that the injury to the defendant would be greater than the advantages to the complainant, as in Hoe v. Advertiser Company, 14 F. R., 914, and thus on terms which seemed reasonable to the court, it in effect granted a compulsory license, at least for the time the suit was pending.

Suppose a case where the public health, public safety or the welfare of the nation were involved, what would a court of equity do should a patent owner seek an injunction restraining the manufacture, sale and use of devices which the evidence showed were essential to prevent epidemics, to save life, to repel invasion, and that there were no substitutes immediately available, would it grant an injunction, or would it refuse the injunction because of the "reasonable requirements of the public" and decree compensation in damages and profits, thus in effect granting a compulsory license? We believe that in such a case a court of equity would not hesitate to refuse an injunction, on the ground that an injunction would operate injuriously upon the public without benefiting the complainant. It would however decree an accounting so as to ascertain the amount of damages and profits which would be payable to the owner of the patent for this compulsory license. Such a proceeding would not differ materially from that provided by Section 17 of the Oldfield bill to compel the granting of a compulsory license. It would therefore seem that in many cases where the "reasonable requirements of the public" seem to require it, compulsory licenses are awarded by the courts.

Legal Notes

Patentability of Article as Affected by Process of Making.—In affirming the decision of the Commissioner of Patents, *In re* Hodkinson application for patent for an iron or steel conduit pipe, the Court of Appeals of the District of Columbia has held that in considering the question of the patentability of an article made by whatever process one may choose to employ, the superiority of the process by which it is actually made is immaterial.

Some Adjudicated Patents.—In the suit of the Carlson Motor and Truck Company v. Maxwell-Briscoe Motor Company, 197 Fed. Rep., 309, claim 1 of the Carlson patent, No. 797,555, for internal combustion engines was held valid and infringed. In recently decided cases, the Coffield reissue patent, No. 12,719 (original number 806,779) was held valid and infringed; the Mell patent, No. 898,907, for vehicle wheel tire, was held void for lack of invention in view of the prior art; the Washburne patent, No. 517,084, for a cuff fastener, was held void for anticipation, also not infringed if conceded validity; the Washburne patent, No. 553,972, for a clasp or fastener, was held not infringed; the Moody patent, No. 591,869, for an electric transformer, was held not infringed, and the Coldwell and Gildard reissue patent, No. 11,923 (original number 637,234), for a stop motion for looms, was held valid and infringed.

Substitution of Material.—The question of patentability involved in the substitution of material raises interesting questions. The case of *ex parte* Hobbs decided by Commissioner Moore, in which he affirms the decision of the Board of Examiners in Chief, involved the substitution of sheet metal for wood in billiard counters and the Commissioner held that it did require invention, the advantages alleged for the metal counters being due to the well-known properties of sheet metal. In discussing the case, the Commissioner said it was believed to fall in the class of devices held to be unpatentable by the substitution of material, citing certain cases, because the substitution developed no new uses or properties, rather than in the class where the substitution was held to involve invention and to be patentable. He referred to the distinction between the two classes being well set forth in Union Hardware Company v. Selchow, in which the Court said, quoting another case: "Both involve a change of material in existing structures but in the one instance the skate operates after the change precisely as it did before, and in the other a hose supporter which does not support is converted by the change into a hose supporter which does support. In the former case by the use of cheaper, lighter and stronger metal the skate is made cheaper, lighter and stronger, in the other the substitution of a rubber button for a metal button transformed a destructive and inoperative device into a highly successful one."

Notes for Inventors

Adds Rubber to Resene in Chewing Gum.—In a patent, No. 1,040,285, James D. Darling, of Philadelphia, describes a process of manufacturing chewing gum in which he adds to resene a suitable proportion of rubber to render it plastic at the temperature of the mouth.

Clothes Washing Pounder.—In patent No. 1,039,701 to Edwin R. Crooker, of Los Angeles, Cal., there is shown a clothes pounder with a conical body having a handle socket at its apex with a soap receptacle within the conical body at the apex and immediately below the socket for the handle.

High-grade Flour from Low-grade Grain.—For producing a high grade of flour from a grain low in proteids Johann Georg Ferdinand Dombach, of Amsterdam, Netherlands, has patented, No. 1,040,290, a process for treating the grain which consists in mixing with a quantity of the grain low in proteids about one half as much more of light grain incipiently germinated, but whose germination is stopped before reaching the stage to produce malt.

A Demand for Coal-weighing and Discharging Machine.—One of the Consular and Trade Reports of the Department of Commerce and Labor calls attention to the fact that an American consul has inquiries from a firm in his district for automatic apparatus for discharging coal from vessels, indicating that the apparatus should be capable of weighing the coal as it is removed and suggesting that a suction type of equipment which will remove the coal from below decks into the square of the hatch lifted up on deck, weigh it and deliver it into lighters, is desired.

A Piano Violin Patent.—Walter E. Fox of Chicago has secured patent No. 1,036,600 for a musical instrument in the form of a piano violin having a keyboard and means for simulating the playing of a violin which include in connection with framing, a vibratory string and an endless band traveling across the string and between pairs of rollers and twisted thereby to present a broad surface to the string and also means actuated from the keyboard for rocking the shaft carrying the rollers in order to move the band into engagement with the string.

A Syrup with Maple Sugar Flavoring.—At this time when, so much is being said about the high cost of living, it may be interesting to note that a West Virginia man has patented what he terms a saccharine article of commerce which is composed of sugar and an extract obtained from the outside lifeless bark of the rock or sugar maple so that the syrup will have a maple flavor. In the process of making this article, the outside lifeless bark taken from the trunk of the rock or sugar maple tree is boiled in water until an extract of the desired strength is obtained and the liquid is then strained and commercial sugar added and boiled until the strength is satisfactory.

An Unsinkable Rubber Boat.—At the recent Rubber Exposition in New York, Mr. Joseph Pastorel of Asbury Park, N. J., exhibited an ingenious rubber boat. The frame is covered with sheet rubber or rubber cloth in such a way as to form independent air-tight compartments which can be inflated to increase the buoyancy of the boat. The elasticity of the materials employed, in the opinion of the inventor, will enable the structure to withstand severe blows and shocks. When subjected to rough usage, the boat, he states, will yield instead of breaking, as it undoubtedly would if wood or iron were employed in its construction. Masts, inflatable square sails, and wings are included in the equipment of the boat. The sails and wings are made of rubber and can be inflated by compartments, the idea being that they will add to the buoyancy of the boat. When lowered all the way down, the sails rest on the deck and the wings right at the edge of the boat. The masts are made of hard rubber.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

HAT BOX.—U. ULLITZ, 228 Audobon Ave., New York, N. Y. This box is constructed of telescopic sections with means for holding the sections at predetermined positions relatively to each other to accommodate hats of different sizes so that the hat box may be packed in a trunk without danger of injuring the hat. The head of the outer end of one of the sections is removable to permit the user to reach the interior of the hat box.

Pertaining to Aviation.

GYROPLANE.—N. E. BROWN, Grand Haven, Mich. This invention contemplates a revoluble aeroplane adapted to ascend or descend vertically, either in a horizontal or inclined path. The invention is preferably termed a "gyroplane," this name being appropriated by reason of the analogy which the machine bears in action to the gyroscope.

Electrical Devices.

HIGH POTENTIAL INSULATOR.—LOUIS STEINBERGER, Brooklyn, N. Y. Mr. Steinberger's invention relates to high potential insulators, and more particularly to such insulators of special form as are adapted to be mounted upon a wall, a floor, a roof or a partition or adapted for use in connection with oil switches and oil transformers, and in various analogous relations.

TROLLEY WIRE SWITCH OR FROG.—J. KIRBY, P. O. Box 415, Douglas, Ariz. An object here is to make an easy and more reliable connection between the main line wire and a switch wire than has hitherto been possible. Also to provide means for reducing the danger of a misplaced trolley from becoming lodged in a switch or frog.

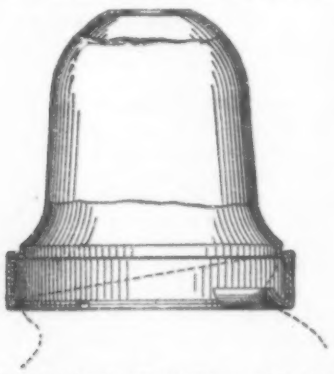
CONNECTING TERMINAL.—A. J. ALLEN, Room 1821 Tribune Bldg., New York, N. Y. This invention provides a contact member to be secured upon the end of a flexible conducting cord or the like, said member having a portion serving the double purpose of a wing screw for holding said member upon said cord and fitting upon a binding post for the purpose of establishing electrical communication from said cord to the same.

Of Interest to Farmers.

DOUBLE KNIFE BOX FOR BEET ROOT SLICING MACHINES.—M. PASCHEN, care of Alexander Katz, Köthen, Germany. In the present invention the clamping plate of the front knife which serves as counter-piece for the rear knife is tippable about an axis in proximity to its front edge in a manner known in connection with single knife boxes and front knife counter-pieces of double knife boxes and is provided with height adjusting means for its rear upper edge, which adjusts the rear edge of the bearing plate in height independently relatively to the cutting edge of the rear knife without the whole of the front knife being simultaneously moved forward parallel therewith.

Household Utilities.

SHADE HOLDER.—H. GOODFRIEND, care of Chicago Gas & Elec. Fixture Co., 4445 Clinton Ave., Chicago, Ill. This invention relates to an improvement in shade holders for incandescent and other lamps and it embodies a construction that is designed to enable the shade to be readily and easily attached in position with reference to the lamp globe or bulb, and as readily removed therefrom in case of danger or when, for any other reason, removal



SHADE HOLDER FOR INCANDESCENT AND OTHER LAMPS.

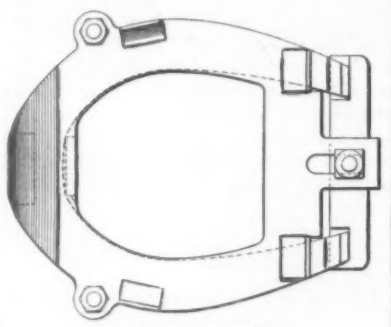
is necessary. Its use is not restricted to a shade holder, but may be employed in other relations. The holder may be attached to the lighting fixture on which it is used either in upright position or in horizontal or inverted position. The engraving pictures a side elevation of the shade holder, partly in section, showing the construction of the holder.

Of General Interest.

ADJUSTABLE SPRING BEARER.—F. A. RABBE, 892 Jefferson Ave., Brooklyn, N. Y. This invention has reference to a new and improved spring-bearing roll for use in printing presses, to draw off the paper without breaking, and to allow for several thicknesses of paper on the roll.

BANANA PACK SADDLE.—A. E. ROBBINS, P. O. Box 536, New Orleans, La. This saddle is designed for use in carrying bunches of bananas from plantation to receiving or loading stations. The saddle comprises a top pocket, side pockets below the latter at opposite sides of it and intermediate pads forming partitions between side and top pockets. Means provide for protecting the fruit from bruises from projections in the road and injury from the sun.

OVERSHOE FOR HORSES.—C. G. DELANO, R. F. D., Taunton, Mass. The object of this overshoe is to prevent the slipping incident to certain conditions of slime covered roadways and to sleet and ice-covered pavements, the said calks are sharpened, and preferably formed from suitable hard wearing material



OVERSHOE FOR HORSES.

such as chilled or air-cooled steel. In the usual practice to which the employment of the shoe lends itself, the overshoe is carried for use in any emergency. The engraving presents a bottom plan view of the overshoe, showing the same in conjunction with the ordinary wearing shoe to which the overshoe is secured.

Prime Movers and Their Accessories.

EXHAUST MOTOR.—C. F. HIGH, 1433 Williamson St., Madison, Wis. The principal object of this invention is to provide a motor construction whereby the power of an engine may be increased and the operation thereof rendered more efficient by taking care of the exhaust from this engine and utilizing the power present within.

Pertaining to Recreation.

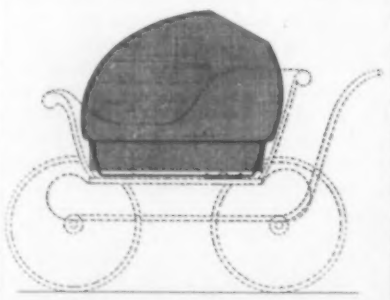
MECHANISM FOR OPERATING TOY DERRICKS.—A. PFEIFFER, 550 W. 144th St., Manhattan, N. Y., N. Y. In this case the aim of the inventor is to provide a new and improved mechanism for operating toy derricks arranged to raise, lower or swing small loads by the use of a motor driven mechanism easily controlled by children, affording considerable amusement and at the same time providing

MECHANISM FOR OPERATING A TOY DERRICK.

an instructive toy. A boy or other child can readily control the motor by manipulating the reversing lever thereof, and also readily control the two handles for operating the derrick with a view to raise or lower the load, to swing the boom up or down or sidewise on turning the post. A side elevation of the invention is shown in the illustration.

Pertaining to Vehicles.

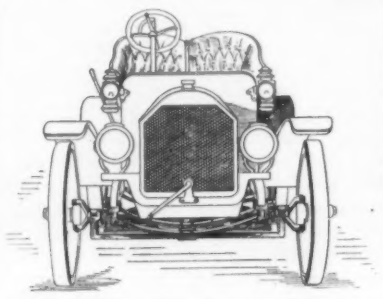
ATTACHMENT FOR BABY CARRIAGES.—J. T. MURPHY, 850 Oakland St., Brooklyn,



ATTACHMENT FOR BABY CARRIAGES.

N. Y. This attachment supports a canopy or mosquito netting, and is adapted to be fitted to any carriage within the limits of adjustment of the attachment. Provision is made for adjusting the device as to length and width, in accordance with the size of the carriage body with which it is to be used. The invention comprises a bottom frame having side bars and a cross bar, and upwardly extending end members that curve inwardly toward each other and overhanging at the top, the one end member overhanging to a greater degree than the other. The engraving shows a side elevation with the netting in place, a carriage being indicated in dotted lines. The invention can be used on a bed couch or the like.

SUSPENSION DEVICE FOR AUTOMOBILES.—J. P. WILL, 261 Union St., Jersey City, N. J. To deaden the jolting and jarring encountered in passing over rough roads, the suspension frame is so designed that the body of the vehicle is supported on axles with its center of gravity in the lowest position; and it includes an arrangement of vertically and horizontally yieldable springs, by means of which the vibrations of the vehicle in motion

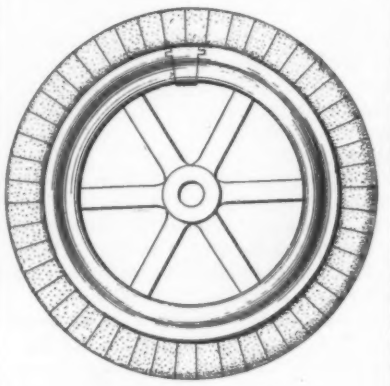


SUSPENSION DEVICE FOR AUTOMOBILES.

are reduced to a minimum, thus permitting occupants to travel with the greatest degree of comfort even when rubber tires are not used. The illustration herewith shows a front view of an automobile showing the suspension frame in place between the vehicle body and the front axle thereof.

VEHICLE JACK.—B. F. LIDDON, care of W. T. Adams, Corinth, Miss. This automatic jack is for axles of automobiles and other wheeled vehicles, the same having a rocker body to which is pivoted an axle-supporting bar adapted to automatically engage an axle when a vehicle is run over the jack. It is particularly adapted for use in supporting automobiles so that their tires may be entirely relieved of pressure when in the garage.

VEHICLE WHEEL.—PAUL D. MURO, Habana, Cuba. The present invention has reference to vehicle wheels and it has for its object the provision of one with a rim having converging sides so that the tire sections having lateral extensions at their inner ends may be



VEHICLE WHEEL.

held between the sides of the rim to be slid into position, the tire sections being introduced through an opening in one of the sides of the rim which is normally closed by a door hinged to the rim. A side elevation of the invention is represented in the engraving.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We are prepared to render opinions as to validity or infringement of patents, or with regard to conflicts arising in trade-mark and unfair competition matters.

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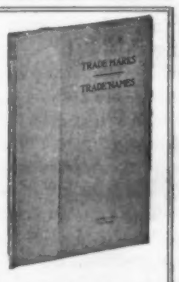

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Launching of the Battleship "New York"

(*Concluded from page 368.*)

Dakota," and so on. As we have said, the principal difference between the "New York" and the "Wyoming" is found in the armament. The new 14-inch gun is an extremely powerful weapon and a great advance upon the 50-caliber 12-inch gun of the earlier ship. The increase in dimensions and power over the 12-inch type is as follows: Length, 54 feet, as against 51 feet; weight, 63.3 tons, as against 56.1 tons. The velocity is less by 300 feet, being 2,600 feet per second at the muzzle, as against 2,900 feet, but the shell has gone up in weight from 870 to 1,400 pounds, and the muzzle energy has risen from 51,644 to 65,687 foot-tons. The extreme range has fallen from 24,000 yards to 21,000, a matter of no significance, as this range will never be used in practice. The penetration at 10,000 yards is about the same, being 15.6 inches through Krupp armor for the 12-inch guns and 15.9 for the 14-inch guns. The greater power and effectiveness of the 14-inch piece is due chiefly to the very large bursting charge of high explosive contained in the shell, and the larger number and greater total weight of the flying fragments. Three or four effective hits, with penetration, out of a salvo of eight or ten 14-inch guns would go far to settle the fight, either by immediate disablement or such damage to the ship and demoralization of the crew as would prevent the enemy from doing effective work during the rest of the engagement.

An interesting fact concerning the "New York" and the "Texas," is that they are both propelled by vertical, triple-expansion engines. This type of motive power was decided upon at the time when the efficiency of the steam turbine had not reached the point which it holds to-day; for the introduction of reduction gear seems in a fair way to solve the difficulties of the turbine marine drive. It is likely that the "New York" and "Texas" will be the last ships of our Navy to be driven by reciprocating engines.

The "New York" is protected by 12-inch Krupp armor on waterline and gun positions. The secondary battery consists of twenty-one 5-inch rapid-fire guns.

Aerodynamic Experiments of Duc de Guiche

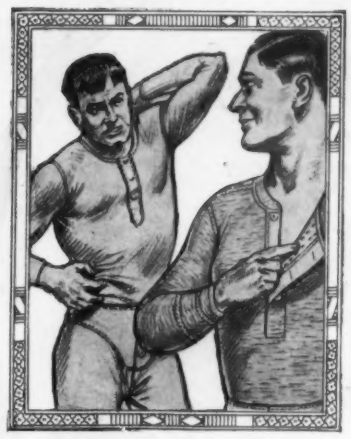
(*Concluded from page 368.*)

the front plate of the car, and when running it was seen that the streamer kept quite parallel to the car's direction, showing that there were no rising or descending currents at that level.

The inventor used a method by which he was able to take a very accurate record of the air pressures upon different points of the surface of the plate. The pressure at any given point was obtained by using a small open tube which ran through a hole in the plate and lay flush with the surface. The tube was connected by a rubber tube to a pressure gage placed on the automobile. After trying various kinds of gages, he settled upon a simple U-tube partly filled with liquid and having the rubber tube attached to one branch, while a scale placed in the rear served to show the pressure by the rise of the water column. By narrowing up the tube in the bent portion it was possible to use distilled water for the gage without any marked vibrations due to the running of the car, thus avoiding the use of glycerine or other heavy liquids.

One of the most ingenious devices is the one which was used to take photographs of the pressure gage records. What is desired is to find the pressures along one line of the test plate at the same time, and by using eight separate holes and tubes along one line he could obtain eight records in a single run of the automobile and was sure that the working conditions were always the same. An instantaneous photograph of all the eight gages in line was taken at the moment when the automobile passed the line, and a permanent record was thus fur-

This Wool Can't Scratch You



IT'S on the outside—*where sheep wear it*—where it keeps you warm without touching the skin. Inside is cotton—soft and grateful—two fabrics in one—joined by wide firm stitches about half an inch apart. Between the materials the air circulates and keeps the garment fresh and dry.

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Duofold Health Underwear Co., 26-38 Elizabeth St., Mohawk, N. Y.

Issue of December 7, 1912

The Grand Central Terminal

Illustrated by Jules Guerin

There will soon be opened in the city of New York a gateway that leads into the heart of the western world's greatest city, a gateway that symbolizes the peace-making work of the engineer and the changes that he has wrought on civilization.

To Mr. Jules Guerin, one of the most distinguished artists of our time, has been intrusted the task of presenting the symbol. He has made for the SCIENTIFIC AMERICAN two masterpieces—one of them a colored cover, in which the station is shown looming up mysteriously in the night, illuminated from within by its own myriad lights and from without by the welcoming lights of the metropolis. He has also prepared a double page drawing of the "Terminal City"—a drawing in which the brush and pencil have explained better than mere words can explain it.

The engineering side will be treated in the usual SCIENTIFIC AMERICAN way. Fascinating, indeed, will be the story of the work. Few realize that in the Main Station alone there are approximately 28,930 tons of steel; that the total excavation amounted to 3,094,750 cubic yards; that there had been removed up to May 1st, 1912, 203,925 carloads, which would make a train reaching from New York City to Omaha; and that to blast out the 2,000,000 tons of rock, 730,000 pounds of dynamite have been used. Then, too, there is the story of the tracks, how they are connected with the subway, how they have been laid underground tier on tier, and how the whole station has been planned so that it would be not an eyesore, but an architectural adornment to a great city.

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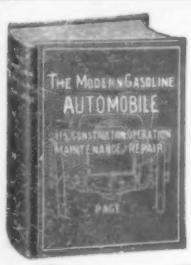

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nished. One of our views shows the eight tubes leading from the test plate to the box containing the pressure gages. In the box is an illuminated scale and a camera for taking the record, and the operator works the shutter while the automobile is between the rubber tubes on the road. Added to the series of gages is an extra gage with both ends free and having the water columns both at the same level, in order to serve as a check and to enable one to make any slight corrections for the movements of the liquid when on the road.

By taking the pressures along various lines of the test plate, a chart is obtained which shows the pressure all over the plate. The method employed by the Duc de Guiche appears to be one of the most accurate yet employed for such experiments.

The Bushmen of Africa

(*Concluded from page 370.*)

not so finished the obvious inference is that the artists had not the same leisure in which to do them—probably being harassed by enemies or having to make long journeys to replenish their food supplies. Under the more adverse circumstances their unique mural decorations were not so perfect in detail. The markings on the animals, if not reproduced in their actual colors, have nevertheless been defined with striking clearness by the rude painters with the meager means at their command. Mr. Thomas Baines, F. R. G. S., the celebrated South African traveler, has held that the coloring was done with a feather; but in Dr. Elmore's opinion the extreme fineness of many of the lines effectually combats this contention, and that a people able to execute such paintings would make brushes by binding together bristles plucked from dead animals.

Etching on parts of the rock is also shown to have been freely indulged in by the Bushmen, and with a truly astonishing degree of skill. Such work is found on the flat, smooth rocks in different parts of the colony and exposed to the weather; but seldom are paintings and etchings to be seen together.

At Vryburg, just before entering Mafeking, are some fifty or sixty etchings, each Dr. Elmore states, magnificently done. One of them, a giraffe, over two feet in height, is a really beautiful specimen, and near it are outlines of hippo and eland.

A somewhat striking difference between the etchings and the paintings (although both are always found in profile) is that in the former the eye of the animal is distinct, whereas it is almost invariably non-existent in the latter.

Having obtained a thorough insight into the subject of the Bushmen paintings so far as South Africa is concerned, Dr. Elmore has left for Australia, for he has learnt that the aborigines there also decorated their dwellings with quaint colored drawings. From the Commonwealth, after careful investigation, he proceeds to the United States, and then directly for Arizona, to study the primitive etchings in that district. His object is to ascertain whether any connection between the three may reasonably be deduced.

The Heavens in November

(*Concluded from page 371.*)

Pleiades, and is well placed for observation, being in opposition on the 23d. His rings are now seen widely opened, and he is a splendid telescopic object.

His largest satellite, Titan, appears of magnitude 9.4, and is therefore visible in any telescope exceeding two inches in aperture. The next brightest satellite, Rhea, is of magnitude 10.8, and, if isolated, might be seen with an aperture of 2½ inches; but, being near the planet, an aperture of 3 inches will probably barely show it. The next two satellites (counting inward toward the planet) Dione and Tethys, are of magnitudes 11.5 and 11.4, and require fully 4 inches aperture to show them. Titan, whose period is very nearly 16 days, may be found on the west of Saturn on November 3d, south on November 7th, east on the 11th, etc. Rhea,

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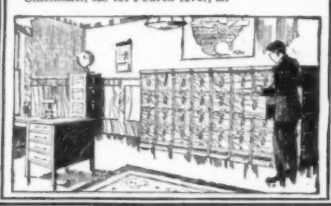

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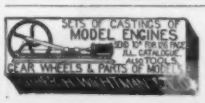

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When the heat of the body—98 degrees—heats the air in the pen, the air expands, pushes up through the inky feed tube, and drives the ink up and out, sprawling it all over the writing end of the pen to smudge your fingers when you remove cap to write.

The Parker Pen is built with a *curved* feed tube; one end of it touches the barrel wall. See X-ray photo.

This touch starts Capillary Attraction. That Capillary Attraction sucks the ink down and out of the Parker feed tube before the warm expanding air goes up. Of course, when the air goes up in the Parker, no ink goes with it.

Thus do you see how the science of Physics keeps the Parker Pen from leaking?

Parker Pens write smoothly, for they have 14k gold pens tipped with hardest iridium. They never blot or skip because the Parker Spear Head Ink Controller keeps ink from flowing too fast or too slow.

Parker Lucky Curve Fountain Pens, $2, $2.50, $3, $4, $5 and up, according to size and ornamentation.

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whose period is 4 days 12 hours, is east of the planet at 3 A. M. on the 3d, 3 P. M. on the 7th, etc. The observer with an astronomical telescope will, of course, remember that it "inverts" the object under observation, so that the satellite will appear east of the planet when really west of it.

Uranus is evening star in Capricornus, now pretty low in the west. Neptune is in Gemini, and comes to the meridian about 4 A. M.

The Moon is in the last quarter at 9 P. M. on the 1st, new at 7 P. M. on the 8th, in her first quarter at 4 P. M. on the 16th, and full at 9 A. M. on the 24th. She is nearest us on the 3d, farthest away on the 16th, and nearest again on the 28th. She is in conjunction with Mars on the 8th, Mercury on the 10th, Jupiter and Venus on the 11th, Uranus on the 14th, Saturn on the 24th, and Neptune on the 28th.

Princeton University Observatory.

Panama Exposition Postage Stamps

THE Postmaster-General recently in approving the designs prepared by the Bureau of Engraving and Printing for the special issue of postage stamps to commemorate the opening of the Panama Canal, directed the 80,000,000 one cent, 150,000,000 two cent, 8,000,000 five cent and 5,000,000 ten cent stamps be prepared, and that they be placed on sale beginning January 1st, 1913.

The series comprises four denominations, as set forth above. The stamps are about three fourths of an inch high by one and a sixteenth inches wide; at the top appear the words "U. S. Postage" and "San Francisco, 1915," in the left hand border is a branch of laurel and in the right hand border a palm branch; a numeral expressing the denomination is shown within a circle in each lower corner, with the word "cents" between. The one-cent stamp is green and in the center appears within a circle, a bust of Balboa, discoverer of the Pacific Ocean, looking to the left, and wearing a cuirass and a helmet with a plume. On either side of the background are palm trees with the ocean in the foreground. Below the portrait, in a horizontal panel breaking the circle, are the words "Balboa, 1513."

The two-cent stamp is red. It represents the Gatun locks of the Panama Canal, with a merchant steamer emerging from one lock and a warship in the other. The mountains of the Isthmus appear in the distance, and palm trees on the right hand side of the locks. Beneath the picture are the words "Gatun Locks."

The five-cent stamp is blue, and presents the Golden Gate of San Francisco harbor, with the setting sun in the background and a steamer and a sailing vessel in the bay. The words "Golden Gate" appear below the picture. The ten-cent stamp is dark yellow. The subject is "Discovery of San Francisco Bay," from a painting which represents the discovering party looking out upon the distant bay. All of the new designs are fine examples of the engravers' art.

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(12691) F. S. asks: In general, and under normal conditions, if not growing too closely together, the trunks of nearly all trees of all species grow straight upward, that is, perpendicular, whether they grow on the level or on any steep incline. What natural law operates here to bring about this effect? A. A tree grows toward the light and warmth of the sun. In general this causes a growth vertically upward when the trees are thickly set over the ground, or when one tree stands out alone. In a small clump of trees the trunks usually lean outward and away from each other. The slope of the land does not affect the direction of the growth of trees to any appreciable extent. Trees show the effect of warmth by extending their branches farther out on the south side, and by forming the annual rings thicker on the south than on the colder north side. One can usually tell very easily how a tree stood as to the points of the compass by an inspection of the trunk.

(12692) H. E. C. writes: Upon a sheet of paper place a heap of bronze powder, such as is used in printing. Two wires forming the terminals of a 220-volt direct-current electric circuit, and having a voltmeter in series, are used. Let the ends of the wires be inserted in the heap of powder. If the wires are rather far apart, no current is readable on the voltmeter. The two wires are then approached to each other, and gradually the needle of the voltmeter indicates the passage of a current. The wires may then be drawn a distance apart and the current persists. Now comes the astonishing feature. If the wires are rather close to each other, and a current passing, then upon slowly lifting the wires out from the powder the needle of the voltmeter does *not* come back to zero. We have succeeded in raising the wires as much as one inch from the powder and one inch from each other without the breaking of the current. At first sight it looks as though there is a silent passage of current through an inch of air. Upon closer inspection, however, it will be seen that there extends either from one wire to the other, or from both wires to the heap of powder, a spider web thread of bronze powder. The current passes through this thread. Upon the first discovery of the thread we thought that some liquid was mixed with the powder, but this was soon proven to be incorrect. The disconnection of the electromotive force nullified all efforts to draw out the powder into threads. The same phenomenon was observed with bronze powder which had been cleaned with benzol. The same was observed with graphite, except that with graphite a number of threads could be drawn out simultaneously, and sparking was observed on one or two of them. An attempt to do the same with cast-iron powder was unsuccessful, possibly because the powder was too coarse. A thread extending from one wire to the other could easily be drawn by first placing on the wire a little heap of powder, touching the two wires together, and then gradually drawing them apart in the air. By this means threads an inch long were made. Upon pulling the wires apart too far the thread broke but did not fall; it remained hanging. Upon now approaching the wires together, the hanging thread would curl up against the force of gravity and would always be attracted and attempt to reach and join the other wire, proving immediately that the phenomenon was electric. An explanation of the above can no doubt be easily given by means of lines of force, etc., but we shall leave said explanation to others. A. Our attention has never been called to this interesting experiment before. It may be entirely new. The explanation seems clear. It is probably a case of cohesion of the same sort as occurs in the Branly coherer, which was at first used in wireless telegraphy. The cause of the cohesion of the particles of metal is believed by many to be a welding due to heat. The sparking when graphite was used showed that the heat was considerable. The voltmeter in series becomes an indicator of current simply, a rheostat to all intents as well. Its resistance is not given. If it has the usual resistance of such an instrument, say 19,000 to 20,000 ohms, more than a hundredth of an ampere flowed at 220 volts when the wires touched each other. This is ten times the current necessary to work a coherer, and a strong result would be expected. We have repeated the experiment, carrying the resistance up to over 50,000 ohms, and at 110 volts there was then current enough to burn the graphite and weld the bronze particles. The sparks were produced when the ends of the wires were a good distance apart—¾ inch certainly. We did not succeed in producing the chain of particles hanging from one wire and attracted to the other wire. This seems to be the same action as of the gold leaves of an electroscope, an attraction of unlike charges. The two wires are at different potentials, one charged positively and the other negatively. The tiny chain free to swing is drawn to the opposite charge on the other wire. A gold leaf electroscope can be charged with 110 volts, using a second plate as a condenser. This is an old experiment to show that the electricity of the dynamo and of the static machine are one and the same electricity, differing only in degree of electrification. We feel very certain that the explanation we have suggested is the correct one.

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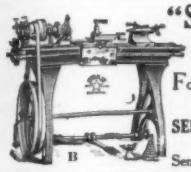

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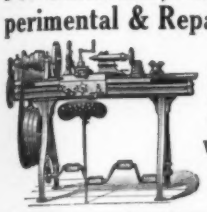

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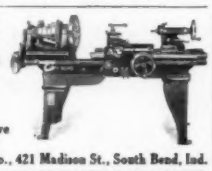

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THOMAS'S REGISTER OF AMERICAN MANUFACTURERS AND FIRST HANDS. New York: Thomas Publishing Company, 1912. 4to.; 3,600 pp. Price, $15.

This enormous volume is the equivalent of a complete library of directories, covering every existing trade, all bound in one volume, with an index naming more than 60,000 articles. It includes over 300,000 names, together with the ratings. This book came into immediate use when it reached the reviewer's table, and we have found it most helpful. No other comprehensive book of a similar nature gives the capital of each company. This will prevent disappointment in mailing large quantities of circulars. One of the most valuable features is the trade name or special brand section, printed on tinted paper, which lists over 30,000 marks in actual use. The work is also printed on a special imported paper, otherwise its enormous bulk would be even more increased. It is an indispensable book for every office, and should have a large annual sale.

TRADE MARKS AND TRADE NAMES. For the Business Man. New York: Munn & Co., 1912. 16mo.; 48 pp.

The purpose of this little book is to present in the simplest manner, consistent with comprehension, an interpretation of the Federal statutes concerning Trade Mark registration and protection. As the book is intended for business men, legal phraseology has been avoided as much as possible, as well as long quotations from court decisions, except where the inclusion of such excerpts was found necessary to a clear understanding of the subject. The Trade Mark is a most valuable asset, and it will pay every business man to know why such marks are valuable and why and how they should be protected. The booklet gives a thoroughly comprehensive idea of the requirements for registration. It tells what may and what may not be registered. The elements of a good Trade Mark are admirably and thoroughly discussed, and nine tests of a good Trade Mark are given. The following is a list of the chapters: Chapter I, The Trade Mark as a Business Asset; Chapter II, The Federal Trade Mark Law (Classification of Merchandise); Chapter III, Analysis of the Requirements of Registration; Chapter IV, The Elements of a Good Trade Mark; Chapter V, Trade Mark Protection; Chapter VI, Practical Information (which should be furnished) the Trade Mark Attorney. The book is beautifully printed in two colors on coated paper, and is illustrated by fifty engravings showing interesting Trade Marks. The price at which this book is sold is so small that it should have a place on every desk.

PER-ACIDS AND THEIR SALTS. By T. Slater Price, D.Sc., Ph.D., F.I.C. New York: Longmans, Green & Co., 1912. 8vo.; 123 pp. Price, 90 cents net.

The series of monographs on inorganic and physical chemistry, to which this work belongs, is issued with the view of giving the advanced student adequate summarized accounts of progress along the most-traveled paths of endeavor. Out-of-date experiments and discoveries, interesting only from the historical point of view, are omitted in favor of recent investigations. The student undertaking research will find these issues of the greatest benefit to him in his work.

DIE URGESELLSCHAFT UND IHRE LEBENSFUERSORGE. Von Dr. Karl Weule, Direktor des Museums fuer Voelkerkunde und Professor an der Universitaet Leipzig. Stuttgart: Kosmos, Gesellschaft der Naturfreunde, 1912.

This volume is to be regarded as the third of a series on Anthropology written by the author. The first two dealt primarily with the origin and development of human culture or civilization. No attempt was made to trace the development of economical ideas. This the author has done in the present volume. He has given us a simply worded lucid little book that will be read with pleasure by those who have no desire to wade through the pages of a more pretentious technical work, but who nevertheless wish accurate information in a small text.

MEYERS HISTORISCHER HANDATLAS. 62 Hauptkarten mit zahlreichen Nebenkaertchen, einem Geschichtsabriss in tabellarischer Form und 10 Registerblaettern. Leipzig: Verlag des Bibliographischen Instituts, 1912.

This volume may be regarded as a splendid example of the map-maker's art. It must be a source of keen regret to every American scholar that it seems to be impossible to produce in this country maps which are as well executed mechanically and as accurate geographically as those which are produced in Germany. Of the sixty-two principal maps of which this volume is composed, twenty-two are devoted to ancient geography and the other two to mediæval and modern times. Special charts are provided to cover the last great wars. The atlas far transcends the rather narrow boundaries of most historical maps, covering as it does the history of colonial development and geographical discovery from ancient times until the present day. The rise of the British colonial empire, for example, is thus presented in a most graphic, we might almost say dramatic way. The more important maps which mark the end of historical epochs are provided with indexes, with the aid of which localities can easily be found. On the back of each map an excellent chronicle of historical events relating to that map is published.

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